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Ecology in Your Community

Examining Your Environment



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Ecology in Your Community



Examining Your Environment

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84 Marshland — Gar Stevens.

Introduction



Introduction

How often have you heard the word *ecology* recently? Do people seem to be worried when this word is used?

Are *you* concerned about ecology?

The activities in this book will help you to understand better why many people are concerned about ecology. You will find out for yourself how the ecology of your own community is connected to the ecology of the world.

To understand ecology, you will have to know some special words. By doing the activities in this book, you will have no trouble learning and using these words to talk about ecology just as scientists do. The Glossary on page 87 will help you whenever you see a new word.

There are seven chapters in this book. Do them all in order and do as many of the activities as you can. What you learn in each chapter will help you to understand the next one.

The first chapter, *About Ecology*, will help you to find out what is meant by ecology. Chapters 2 to 7 will introduce you to important ideas in ecology.

The activities in this book ask you to observe carefully, take measurements, and record your observations. By doing these things, you will learn skills which you can use over and over again to answer other questions.

You will probably be working with other classmates as you do these activities. Before you start each activity, your group should carefully plan the jobs to be done. Ask yourselves in advance:

- Does everyone understand the problem to be solved?
- What equipment will be needed?
- Will you make the equipment or borrow it?
- How will you write down or record your information?
- Who will prepare the information sheet or the *data* sheet?
- Who will do the other jobs?

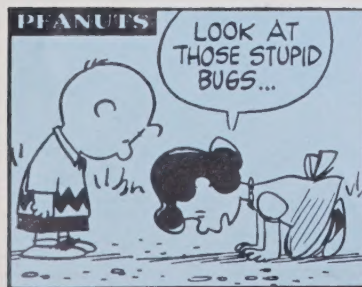
After each activity you will find a *Digging Deeper* section. The questions in this section will help you to find the meaning of the information you collected during the activity.

If you are particularly interested in an activity, you can follow the *Branching Out* suggestions. These contain more ideas for you to explore.

No doubt, you will raise other questions about ecology that are not dealt with in this book. Your questions might be better than the ones suggested by the authors. Don't be afraid to set up activities to answer the questions about ecology that interest you.

Good luck!

The study of ecology will help you to understand more about what is going on in your world.



About Ecology

1



1. About Ecology

People are interested in ecology because it deals with all the ways in which the plants and animals in our world affect one another.

Plants and animals affect our lives too. Just imagine what would happen if there were no trees! How would your life be changed? What foods would you have to do without if there were no cattle?

Sometimes it is hard to think of the ways in which one plant or animal affects another. As you do the following activities you will find out many of these ways for yourself.

The things that people do often change the ways in which plants or animals affect one another. It is important for us to learn whether our actions will be harmful or helpful to the living things around us.



Things in nature such as the water, soil, plants, and animals are like two pupils on a teeter-totter. If one pupil is much bigger than the other or if you change one of the things in nature too much, then the balance is upset and the teeter-totter won't work properly. In ecology, scientists try to learn how to keep things in balance.

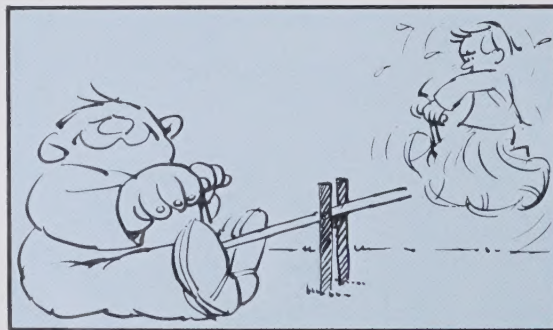
How would your life be different if there were no cattle?

Activity 1:

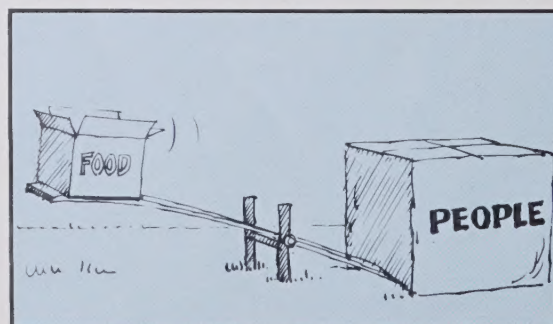
What is ecology?

When your parents and grandparents went to school, they studied some things about *ecology* by doing what was known as "nature study." Whether you call it nature study or ecology, one of the most important ideas is the *balance of nature*.

What do we mean by balance of nature? Think about playing on a teeter-totter. What would happen if the heaviest pupil in your class sat on one end and the lightest one sat on the other end? Which two pupils would you choose to sit on the teeter-totter so that it would balance?



Is this teeter-totter in balance?



How is ecology like a teeter-totter?



Today, in newspapers and magazines, or on radio and television, people are talking about ecology. Perhaps you have heard big words such as: *environment, interrelationships, conservation, pollution, natural resources and energy crisis*. These words have special meanings when people talk about ecology. Do you know what these words mean, or why they are important? Write down what you think ecology means.

Look at the photographs on this page. Decide which ones you think are about ecology and which ones are not. Talk about the reasons for your decisions with other pupils in your class.

Ask some of your friends and some adults to tell you what they think the word ecology means. Write down what they say. Look up the word ecology in the dictionary.



Give some reasons why these headlines might be about ecology.

Digging Deeper

How many different explanations for the word ecology did you collect? Which explanations were most alike? Which explanation was the best one?

What new ideas about ecology did you learn from looking at the pictures?

Did you change your explanation after hearing what other people had to say about ecology? Why?

What are some ways that the balance of nature can be upset? Why do you think scientists are so concerned about keeping a balance in nature?

Draw your own cartoon to show a balance in nature.

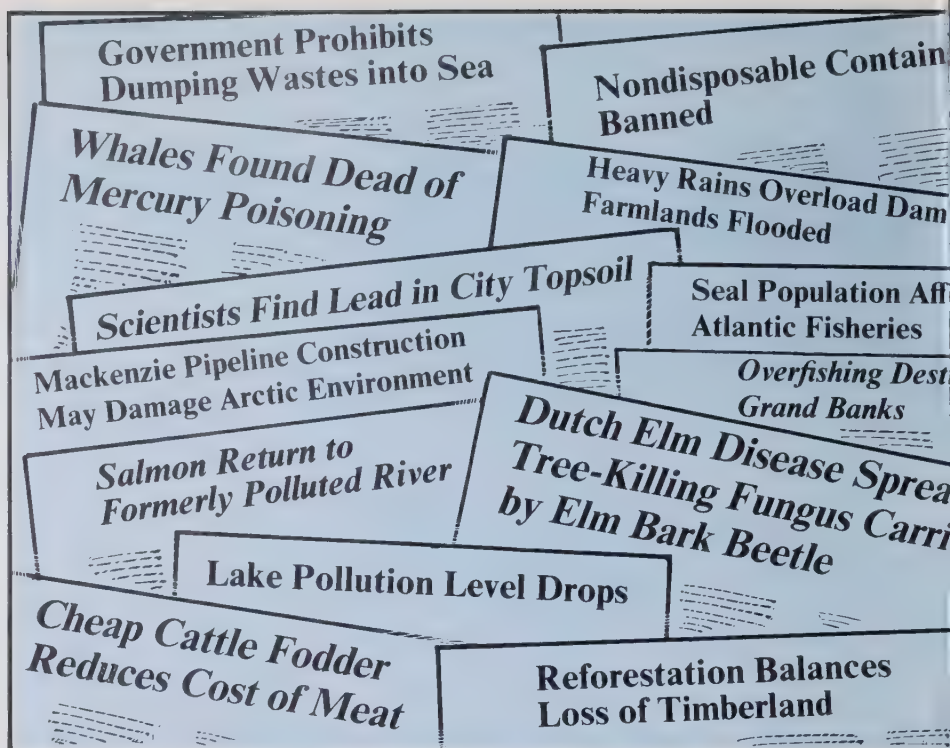
Branching Out

Look at the newspaper headlines on this page.

Are these headlines mostly about animals, plants, water, or soil? Which ones are concerned with pollution or waste? Which ones show concern for a sensible use of natural resources? Can you tell whether or not the person who wrote the headlines was worried, angry, or pleased about what was happening? Sort the headlines into ones which deal with living and nonliving things.

Make your own collection of some newspaper and magazine articles that you think are about ecology.

Which of these articles talk about food, shelter, numbers or amounts of people, animals or nonliving things? Which of them talk about costs, or good or bad changes?



Do any of the articles talk about the same things you read in the headlines? Which ones talked about keeping or changing the balance of nature?

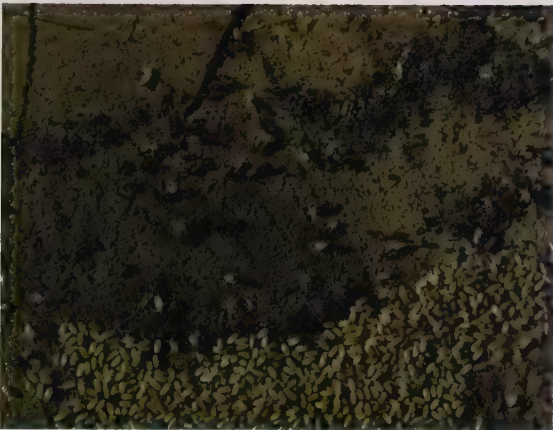
Who are the people most concerned about ecology in the community in which you live? Are there any commercials on television that you think deal with ecology?

Look for words in the articles you collected that you think are special words used when talking about ecology. Try to sort the articles according to these special words. See page 87 for other special words that are used.

Make a scrapbook, putting the articles in groups according to the important words that you have found. You can add to your scrapbook as you find more articles about ecology.

After you have completed each chapter in this book, take another look at your explanation of ecology and decide how you might change it.





Activity 2:
What can you find in your neighborhood that has to do with ecology?

Look at the photographs on these pages. Can you find any similar things in your neighborhood? Each picture shows something important about ecology. Study the photographs and try to find the main idea in each one. Write a sentence about the main idea. Your sentence could start with the words "Ecology is".

For example, one photograph shows a group of ants rather than just one ant. By looking at this picture you might guess that ecology is about many ants rather than just one ant.

There can be more than one idea about ecology suggested in a picture. Perhaps the main idea could be about the home or *habitat* of the ants, or perhaps it is about what some of the ants are doing. Your completed sentence about ecology might be:

- Ecology is learning about *the way ants live*.
- OR
- Ecology is studying *where ants make their homes*.
- OR
- Ecology is finding out *how many ants live in an ant colony*.



Which of these methods of weeding would you use? Why?



2. A homeowner with a female cat for a pet.

Your cat can have from six to ten kittens several times a year. Kittens are very cute and cuddly. If everyone's cat had kittens, what would happen to the cat population in your community? If you can't keep your cat indoors all of the time, a veterinarian can perform a simple operation so that your cat can no longer have kittens. This operation may be expensive.



3. A farmer in a rural community.

You can cultivate your land so that your crops grow right up to the fences. This looks neater and will yield more crops and fewer weeds. Leaving a strip of uncultivated land along each fence will eventually allow a wide variety of plants to grow and provide a habitat for animal life. Most of the animals living in this *green belt* will be useful to both the cultivated and the uncultivated areas. The green belt will also provide an attractive area of wild growth between the fields.

What ideas about ecology are shown in these photographs of cats?

If you were a farmer, which field would be like yours? Why?



Activity 3:

Why is ecology important?

In this chapter you have started to learn some of the important things about ecology. Many of these apply to life in your community. Each section of this activity shows a person in a community who has a problem and must make a decision. Each decision will depend upon what the person knows about ecology and how important it is to him or her.

Pretend that you have the problem and try to solve it by using what you know about ecology.

Select which of the two photographs best illustrates your answer. Discuss your answers with your classmates.

1. A gardener whose lawn has many weeds in it.

It would take many hours to pull up all the weeds by hand. Spraying the weeds is much faster, but the poison will also be eaten by insects which in turn are eaten by birds. Eventually, the poison may kill the birds.

If you were a builder, which of these photographs shows what your building lots will look like? Why?

5. *A homeowner.*

You put your garbage in plastic bags. It is easier to carry out plastic bags on garbage collection days than to put the garbage in cans every day. Garbage in plastic bags is less smelly than garbage in cans. Plastic garbage bags decay very slowly and produce chemicals that are harmful to plant and animal life. These chemicals are carried by rainwater to streams and rivers.

Which of the photographs below shows what your garbage will look like? Why?



4. *A builder of new houses.*

Your houses are going to be built in a wooded area. It is much faster and cheaper to use a bulldozer to clear away all the trees before beginning to build. Also, by removing the trees you can make more building lots with more houses and get more money. By removing the trees, the ecology of the area is completely changed and the plant and animal communities that once provided an enjoyable landscape are destroyed.

If you were a factory owner, which of these photographs shows what your factory smokestack will look like? Why?



Branching Out

Here are some words about ecology that you should know:

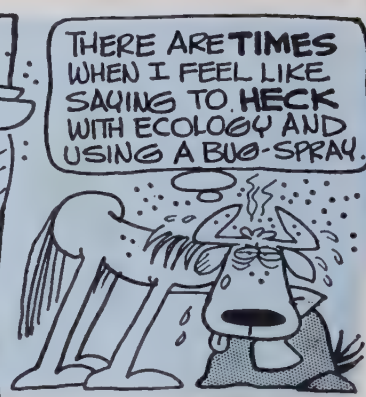
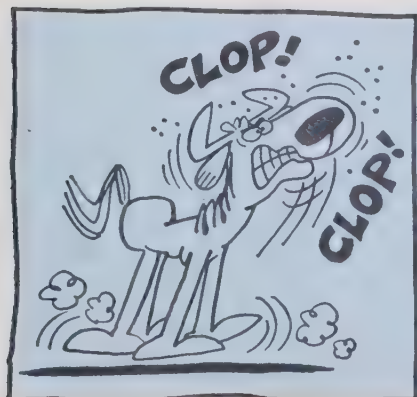
environment	habitat
populations	variation
producers	adaptation
consumers	food chain
succession	ecosystem
interrelationships	recycling
communities	natural resources

Write down what you think each of these words means. Try to match each one with at least one of the pictures you have seen in this chapter.

The activities in the following chapters will help you to understand better the meaning and importance of these words. As you complete each chapter, write down the new things you have learned about these words.

6. The owner of a factory.

Your factory produces a great deal of waste material that escapes into the air. You can install a machine to cut down much of the waste but the machine is very expensive. Your waste material is changing the environment so that some kinds of plant and animal life will no longer be able to live in it.



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BOB
EATON 8-30

What's Around You?

2



2. What's Around You?

The small part of the world in which each plant or animal lives is called its *environment*. The environment contains living things such as other plants or animals, and nonliving things such as soil, temperature, moisture, light, and wind.

You can find many different environments in the area around your home and school. You can also make different environments in your classroom.

You can use these environments to do experiments in order to answer your questions about ecology in a scientific way.

Activity 1:

What makes up your environment?

To begin to answer this question, look around the room in which you are now. Make a list of all the things that you can see, hear, feel, touch, or smell. These things are all part of your *environment*.

Go out into the playground. Check off the things on your list that are also a part of the playground environment. What new items can you find in the playground to add to your list?



Take your list home with you after school. Add other items you find at home that are not already on the list.

Compare your list with other classmates' lists and with the list shown. Add any items that you may have overlooked.

What parts of each environment are the same? Different?

What else do you think Linus knows about his environment?



Some Parts of My Environment

air	sinks	soil
dust	tables	rocks
desks	people	water
chairs	pets	birds
books	flies	buildings
walls	lights	plants
floor	curtains	food
ceiling	clothes	soap
paper	wind	cars
blackboard	rain	concrete
chalk	sun	television
pictures	trees	money
radiators	grass	carpets
pipes	fences	heat

How many of these things are on your list?

Branching Out

Everything in the world can be grouped as being either living or nonliving. Living things grow and need food, while nonliving things do not.

Sort the items in your list of parts of the environment into living and nonliving things. Place an "L" beside the item if it is alive and an "N" beside the item if it is not alive. How many L's were there in your list? How many N's?

What can happen to a plant or animal if its environment changes?

What animals can you think of that *hibernate* or *migrate* because of seasonal changes? What happens to ducks and other waterfowl when ponds and marshes are filled in or drained?

Ask your teacher to obtain the film called *Cry of the Marsh* (see Bibliography). After seeing this film, discuss how changes in the duck's environment affected it. How did you feel about what happened?

What do you think these ducks might do if their pond was drained? Why?

Digging Deeper

What was the greatest number of items in a list? What would be a suitable title for your list?

Which items were the same in different parts of your environment?

Which items in your environment did most people usually overlook?

What would be different in the environment if you were downtown? In the country?

Do you think you could ever list all the items in your environment?

What would be different in your environment in the winter and in the summer?

Which of the things that you listed in your environment are needed for life?

Plants and animals have environments too. Their environments are called their *habitats*. Choose three of the following and list things in their habitat that you think they would need in order to live.

a sparrow	a dog
an ant	a seal
a squirrel	a shark
a mushroom	a dandelion
a maple tree	a rose



You will need materials like the ones shown in the photograph below in order to set up a water environment.



Activity 2:

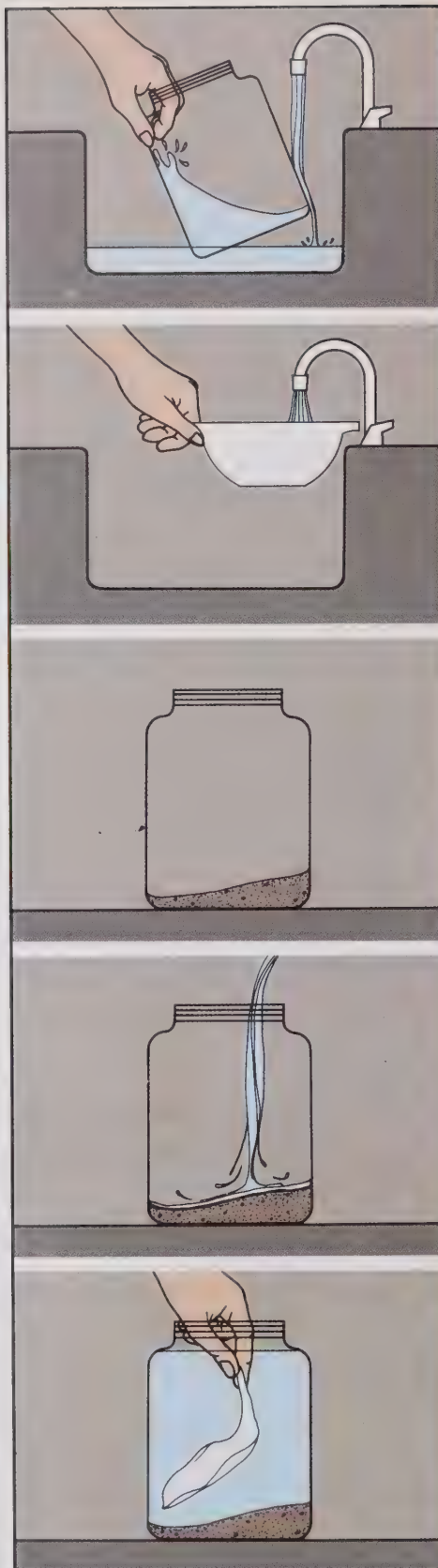
How can you set up a water environment?

One water environment you can make is called an *aquarium*.

Collect the following nonliving materials for your aquarium:

- a large, clear, glass jar with a wide mouth (It should hold about 4 l of water. You can probably get one from a local restaurant if you explain what you want it for.)
- half a pail of coarse sand from a sandbox or jumping pit or crushed gravel from a driveway or small pebbles
- one bag (500 g) of aquarium gravel from a pet store
- a dishpan, sieve or strainer (You can probably borrow one from home.)
- a sheet of white paper and scissors
- tap water

Study the steps shown in the diagram to find out how to set up the nonliving part of your aquarium.



HOW TO SET UP THE NONLIVING PARTS OF AN AQUARIUM

A. Wash the jar thoroughly with warm water. Do *not* use soap or detergent. You do not have to wipe the inside dry.

B. Wash the sand or gravel three or four times to remove dirt and debris. Remove any twigs or leaves that you find. Turn the sand or gravel over as you run the water over it. Swirl the water around until the sand or gravel has been rinsed clean. Do *not* use soap or detergent.

C. Place the washed sand or gravel in the jar so that it is about 5 cm deep in the front and 7 cm deep in the back.

D. Cut or fold a piece of paper so that it covers the sand or gravel in the jar. Pour the water carefully onto the paper so that the sand or gravel is not disturbed. Fill the jar with water to within 5 cm of the top.

E. Remove the piece of paper, being careful not to disturb the sand or gravel.



Let the water stand for at least twenty-four hours before adding anything else to your aquarium.

When you have completed the five steps shown in the diagram, carefully place the jar in a well-lighted spot, but away from direct sunlight. Your aquarium should not be moved again.

Let the jar stand without a cover to allow the water and sand or gravel to settle and the chemicals in the water to escape.

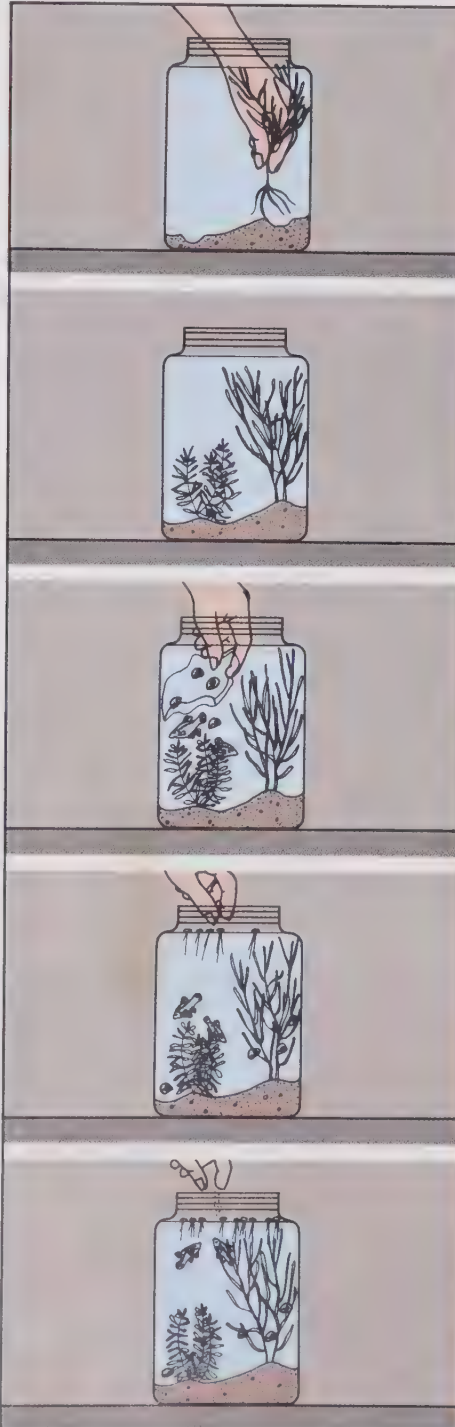
Now you are ready to put the living things into your aquarium. Go to a local pet store and buy the following items:

- two common *guppies* (Ask for one male and one female. If you ask, the clerk will show you how to tell the sex of your guppies.)
- four rooted plants such as *elodea* or *eel grass*
- a handful of floating plants such as *duckweed*
- four good-sized snails
- tropical fish food suitable for your guppies

If you are lucky enough to have a freshwater pond in your area you might be able to collect some of your plants and animals without any cost.

Study the diagram to find out how to set up the living part of your aquarium.

When you have completed the steps shown in the diagram, cover the top of your aquarium with a screw-on cap or a piece of glass. Do *not* punch holes in the lid!



HOW TO SET UP THE LIVING PARTS OF AN AQUARIUM

A. Place the rooted plants in furrows which you can make with your finger. If the plants float to the surface, use a nylon thread to tie a stone to the roots and plant them again.

B. Put the taller plants at the back of the aquarium and the shorter plants at the sides. Leave the middle and the front open, so that you can observe closely what is happening in your aquarium.

C. Place the pet shop bag containing the fish and snails in the aquarium. Let the bag float in the water for about one hour. By that time the water in the bag should be the same temperature as the water in the aquarium. Now release the fish and snails and remove the bag.

D. Place the floating plants carefully on the water's surface. Use only as many plants as are needed to cover about half the surface of the aquarium.

E. When you are feeding your fish, sprinkle only as much food on the water as they will eat in five minutes. Remember that guppies are very small and do not eat nearly as much food as you do. Uneaten food will only pollute your aquarium.



Your aquarium is now complete.

Why should your aquarium not be placed in direct sunlight?

Why should you not punch holes in the lid of your aquarium?

Why should you not use soap or detergent when washing the bottle and gravel?

Why do you have plants, animals and nonliving things all together in the aquarium?

Is your water environment balanced? Explain your answer.



Duckweed floating on the surface of a pond.

Feed the fish only once a day and continue this feeding for only two or three weeks until the living and nonliving things in the aquarium become established. After this your fish will not require any feeding since enough food will be produced in the aquarium itself.

Make a small label for your aquarium. It might show:

- the names of the students who made the aquarium
- the date you set up the aquarium
- the types of fish (Maybe you can name them.)
- the types of plants
- the number of snails

Digging Deeper

What was the total cost of making your water environment?

If you lived in your aquarium, how would you describe your habitat? What other living things could you put in your aquarium?

Branching Out

Once your aquarium is established, you will not have to feed your fish because the water environment is in balance. You could feed the fish once a week by offering them live food. The fish will enjoy this change in diet and you will be able to observe their feeding habits better.

You might interview someone at a local pet store to find out how to set up a live food tank.

These pupils are collecting duckweed for their aquarium. You can also find rooted plants in ponds.





How is this water environment different from the one you made?



A. WHAT MAKES UP THE LIVING ENVIRONMENT IN THE AQUARIUM?

How many groups of living things can you count in your aquarium?

Activity 3:

What can be found in the water environment of your aquarium?

You have learned something about two ideas in ecology — habitat and balance. Now you can find out how habitat and balance can be studied in one environment.

The water environment of an aquarium is a good place to start. In the aquarium there are living and nonliving things which can affect one another. For example, could you imagine what would happen to the fish if the water in an aquarium was drained off? The removal of the water would affect the fish. Perhaps even changing the temperature of the water could affect them.

In ecology, the living and nonliving things found in an environment work together to make an *ecology system* or *ecosystem*.

Plants and animals that live in the same environment are found in groups rather than as individuals. Some groups are larger than others. The number of individuals in a group is called the *population* of the group.

Carefully study the living environment of your aquarium and list the groups of plants and animals. Make a chart like the one shown.

Groups of Living Things in Our Aquarium	
Name of Group	Number in Group (Population)
1.	
2.	
3.	
4.	
5.	

Nonliving Things in Our Aquarium

- | | |
|---------------|----------------|
| 1. gravel | 6. fish food |
| 2. water | 7. glass |
| 3. air | 8. light |
| 4. chemicals | 9. temperature |
| 5. fish waste | 10. dirt |



What nonliving things do these photographs show? Can you find them in your aquarium?



B. WHAT MAKES UP THE NONLIVING ENVIRONMENT IN THE AQUARIUM?

Many nonliving things can be found in an aquarium. Some of these are easy to see. Others are very difficult to find but they are still present.

Study your aquarium and list all the nonliving things you can find in it. Make a chart like the one shown.

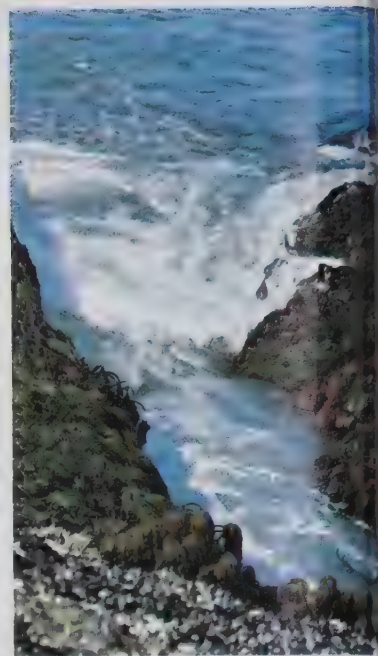
Digging Deeper

How many groups of living things did you record?

Which nonliving things in the environment were the easiest to find? Which ones were difficult to find?

Can one animal or plant be a group? Explain your answer.

Exchange your list of nonliving things with another group. Do you think that they really observed all these things or just guessed? Did you really see all that was on your list?



How does a beaver change the environment to suit its needs?



List as many things as you can find in each of the water environments shown on these pages.

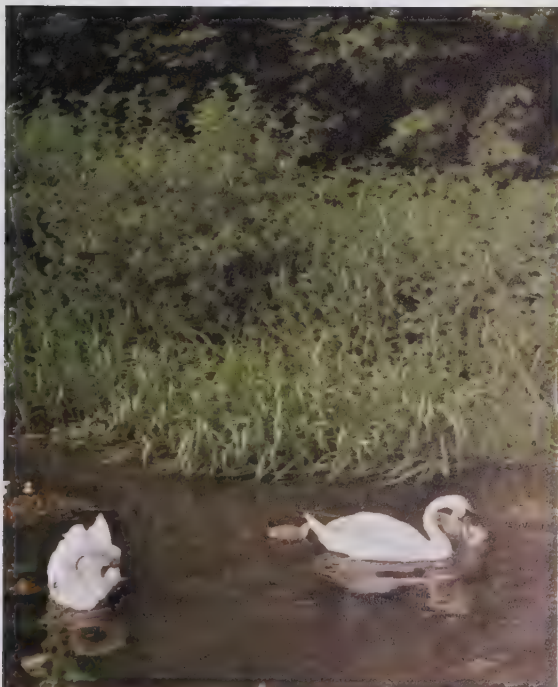
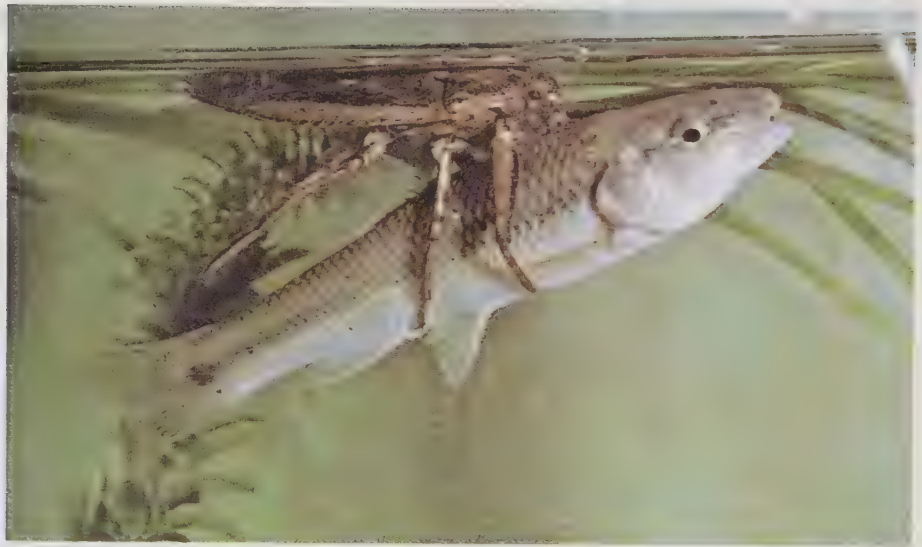
Branching Out

Here are some photographs of different water environments. Examine these pictures and list the living and nonliving things shown in them.

How many are the same as the things that you listed for your aquarium?

One way to learn about the ecology of the water environment is to be patient and observe it every day. Another way is to read about it. A third way is to conduct experiments to find out how ecology works in your aquarium.

Before you can conduct proper experiments, you will need to know how to set up an experiment. *Activity 4* will help you learn how to set up and conduct a proper experiment.





How would you set up a car race so that it is a fair experiment?

What is unfair in each of these photographs? Which car do you think would win each race? Why? ▼

Activity 4:

How is a race like an experiment?

If you know how to run a *fair* race with some of your friends, you already have some idea of how to conduct an experiment.

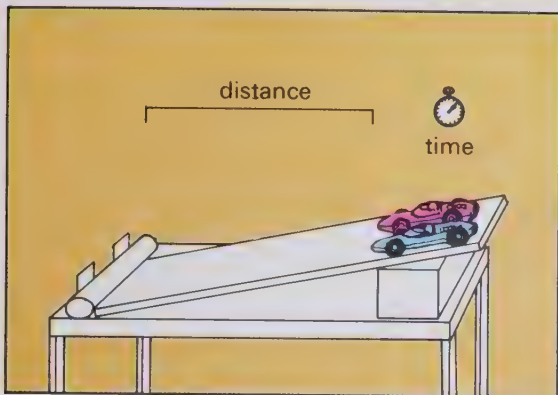
Let's look more carefully at the race shown in the photograph above. There are two different-colored cars in the race. To make it a fair race, if you do anything to one car, you must do the same thing to the other. If you don't, it will not be a fair race and you will not be able to decide which car really won. Suppose your car is the red one and your friend's is the blue one. If the cars roll down the table which one do you think will win?

Now that you have chosen which car you think will win the race down the table, look at the other photographs on this page. Are these races going to be fair?

Do you think both cars in each of the pictures have the same chance to win? Explain your answer. How would you make it a fair race?

If a race is going to be fair, whatever you do to one of the racing cars you must do to the other as well. Only *one* thing in the race can be changed.





In this race the only thing you can change is the color of the cars. Everything else must be kept the same. The starting position, weight, force used to start the cars, and so on, must all be the same. If all these things are kept the same, then you will be able to believe your results.

If you repeat the race several times in exactly the same way, and if the results are always the same, you will be able to believe in the results even more strongly. We can say that these results are *reliable*.

The same rule that was used in the race must be used in an experiment. Only one thing at a time can be changed while all the other things are kept the same.

If you are doing an experiment or having a race you must first decide what is going to be measured. In the race, the speed of the cars was being measured.

Now you must ask yourself: "How can the speed of the cars be measured?" There are several answers to this question. For example, you could use a stopwatch and time the cars, or you could just watch and see which one crosses the finish line first.

Now you must decide what thing is to be changed in the race or the experiment. In the race with the cars, the only thing that should have been



changed was the color of cars and nothing else.

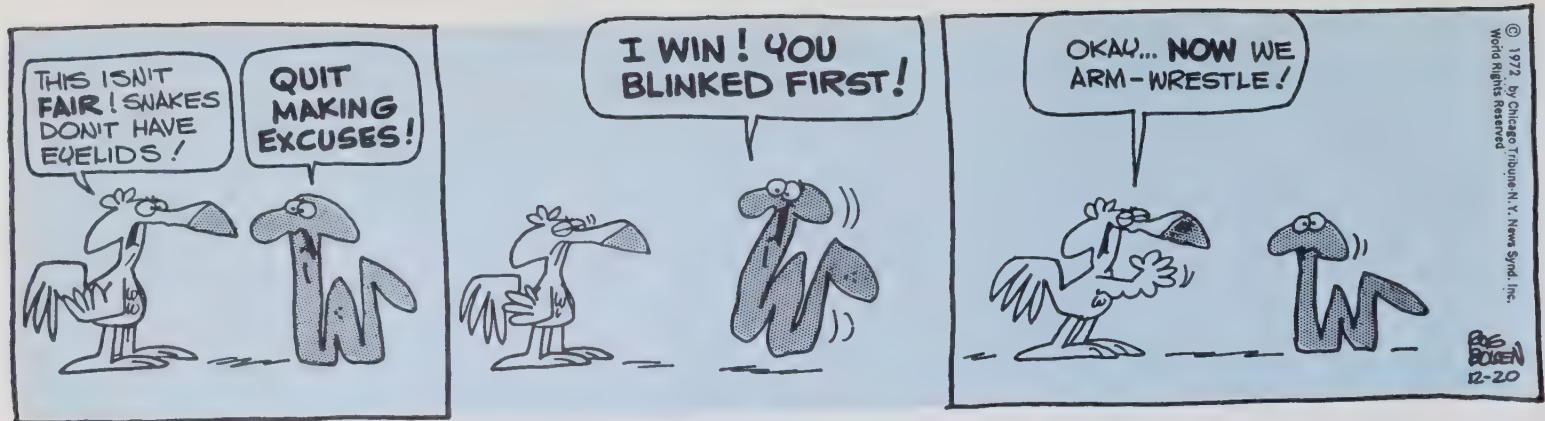
You can now ask the problem question that you want to answer by the experiment. For example, in this race the question might have been: "Will the blue car or the red car travel down the table faster?" Notice the question started with the thing you can change, the cars, and ended with the thing you want to measure, the speed.

You could now ask a second question: "What things affect the speed of the cars?" Here is a list of some of the things that might affect the speed of the cars:

- the size of the cars' wheels
- the weight of the cars
- the starting position
- the force used to start them
- the surface over which they will roll
- the distance they roll
- the steepness of the table

In this race, the car that reached the end of the table in the fastest time would be the winner. This would be the *result* of the race. The result is merely what happened in the race or the experiment. You should run the race again to see if you get the same result.

What is being measured in this photograph?



Digging Deeper

What must you do to make sure that any race is fair?

How many things should you change at any one time?

What thing was changed in the car race?

What must you do with the other things that could affect the speed of the cars?

Branching Out

What you have been reading about is really the steps that scientists take when they do one type of experiment. If you use the following steps correctly you will arrive at a reliable answer when solving your science problems.

Step 1

You come across a problem and ask a question. For example: "Which car will win?"

Step 2

You decide what it is you want to measure. In the example, speed was measured.

Step 3

You decide how you will measure it. You could use a ruler, a clock, or a weighing device, for example.

Step 4

You decide the *one* thing you are going to change. In this example it was the color of the cars.

Step 5

Now you can ask yourself the same question as in Step 1 but this time you combine it with the thing to be changed from Step 4 and the thing to be measured from Step 2. For example: "Will the blue car or the red car travel down the table faster?"

Step 6

Now you can ask yourself the question: "What things might affect the thing to be measured?"

Step 7

It is now time to do the experiment. You can change only the *one* thing you decided to change in Step 4 and you must keep all the other things you identified in Step 6 the same.

Step 8

In recording your observations write the result as a number whenever possible. For example: "The red car took 4 seconds to win."

Step 9

When your experiment is over, write the results in a sentence. State whether or not the thing you changed in Step 4 did or did not affect the thing you measured in Step 2.

Step 10

Repeat the experiment to see if you get the same results.

What would have to be changed in order to make these contests fair?

Problem Question: Does putting a lid on your aquarium affect the amount of water in it after seven days?

Activity 5:

How is an experiment carried out in ecology?

Use the ten steps for doing an experiment to see if you can find some results for this problem question. Step 1 and Step 5 of the experiment have already been done for you. (See the photograph caption.) Now do the following steps on your own.

Step 2

Decide what is to be measured.

Step 3

Decide how it will be measured.

Step 4

Decide what is the *one* thing to be changed.

Step 6

Ask yourself the question: "What things might affect the thing I am measuring?"

Step 7

Do the experiment. Be careful to follow the rule for an experiment. Remember you can change only *one* thing while keeping all the other things the same.

Step 8

Record your observations as a number.

Step 9

State the results of your experiment in this way: The thing changed (fill this in from Step 4) did or did not affect the thing to be measured (fill this in from Step 2).



Step 10

Repeat the experiment using two drinking glasses. Put an aluminum foil lid on one and leave one without a lid. See if you get the same results.

What is the problem question shown in this photograph? ▼



Digging Deeper

What is the rule for an experiment?

Why do scientists use experiments? Do you think there is only one type of experiment a scientist uses?

How many steps are there in the type of experiment you did? Does the rule for this type of experiment ever change?

Why is it very important to decide what changes might affect the thing you are testing and then keep all but one thing the same?

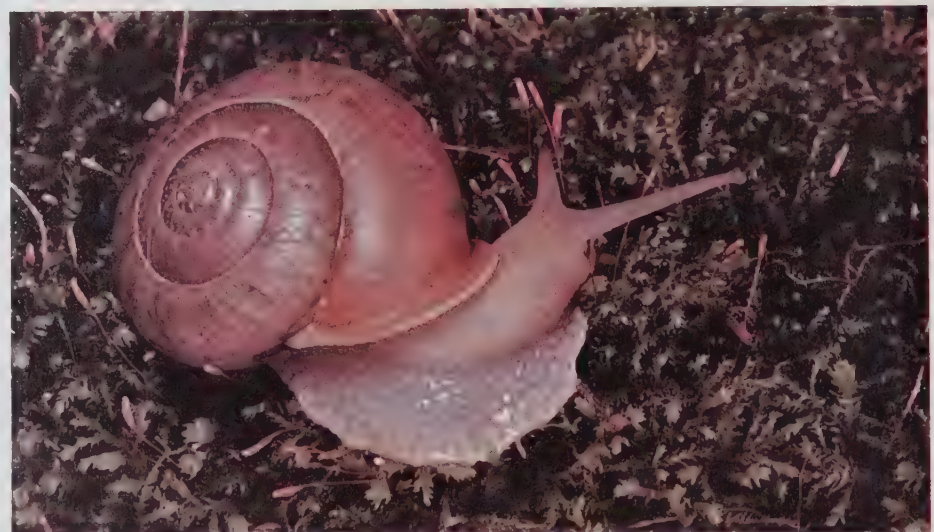
Branching Out

Try doing another experiment. Choose one of these problem questions:

- Does the temperature of the water in your aquarium affect the growth of plants in it?
- Does the amount of light falling on your aquarium affect how green the plants in it are?
- Do different sources of light, for example, sunlight and artificial light, affect how green the plants in your aquarium are?

Remember, whatever you do to one aquarium, you must do to the other aquarium except for the *one* thing you are purposely going to change. Make your experiments fair!

Look in your school or local library to see if you can find any books about Galileo. What scientific discoveries did he make? Why do you think he is called the Father of Modern Science?



Can you think of a suitable name for each of the habitats shown on these pages?

Activity 6:

What are some other types of habitats?

In this chapter you have explored the living and nonliving parts of your own environment as well as the water habitat of the guppies in your aquarium. There are many other types of habitats. Study the photographs on these pages carefully.

Write down a suitable name for each of the habitats shown in the photographs. Make a list of the things that you think might make up the nonliving and living parts of each habitat. Your chart might look like this one.

Different Types of Habitats		
Name of Habitat	Living Parts	Nonliving Parts
1. stream	plants fish insects	water air rocks sand
2.		
3.		
4.		
5.		

Make a list of other habitats that you have not discussed in class or seen in the photographs. You might use resource books from your school library to find habitats that are not well-known.

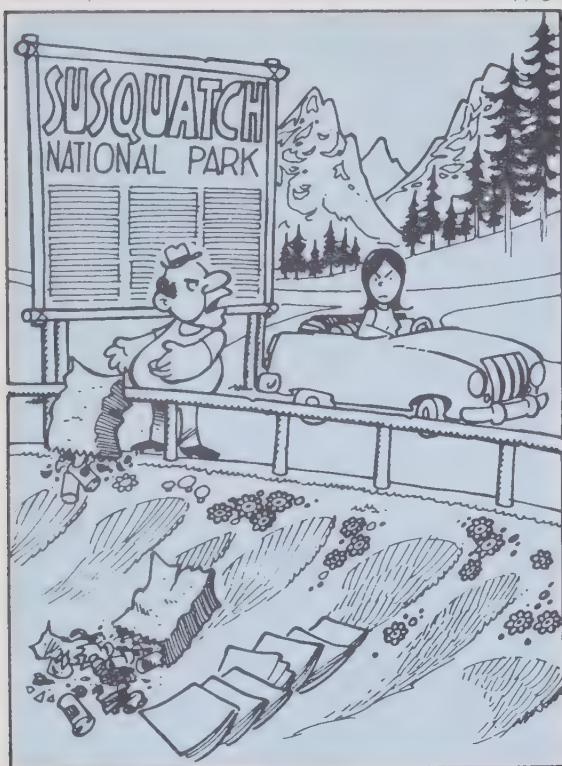


Defining a Habitat

“Each habitat is a special community which is different from any other habitat.” Do you agree with this statement? Explain your answer.

What parts of the nonliving environment are the same in most habitats?

Do you think that a plant or animal which can survive in one habitat might not be able to adjust to changing conditions? Why do you think this might be? Choose one of the photographs above. Suppose that one of the living parts of the habitat is destroyed or in some way removed. What effect do you think this change will have on the other living things in the habitat?



"IT'S MY COUNTRY TOO, AIN'T IT?
I CAN DO WHAT I WANT!"



"OH YEAH. THERE WAS AN ANTI-LITTER SOCIETY
MEETING IN THIS PARK YESTERDAY!"

Do you agree or disagree with what is said in the first cartoon? Explain your answer.

Talking about ecology is not enough. What can you do in your neighborhood to help?

Branching Out

Pollution is one of the things that can affect an environment. Every environment is a special area in which the living and nonliving parts have their place. Sudden changes in a habitat will sometimes have a bad effect on the plants and animals that live there.

These changes are often caused by people. One common way in which people have bad effects on a habitat is by leaving litter lying around.

Study the cartoons above. What type of pollution can you find in each cartoon? What does each cartoon tell you about ecology?

Think of your favorite environment. Are you worried that it could be changed by people throwing away litter, or in some other way? If so, make a cartoon large enough for a poster so that your message is clearly shown.

Display your poster-size cartoon in your school, at home, or in a neighborhood store window.

If you prefer, you could write a poem or make a sign with a catchy phrase.

Do you agree with the writer of this poem?

Who Will Save Our Land?

Smoke flies swirling about the trees,
As they take their places covering the leaves.
Ladybugs are here and there,
But in the plants they're everywhere.

Many a man has ruined this place,
Now little ecology is showing its face.
Man has ruined but man can save,
So let's give better than what we gave.

By Kim Couchman



3. Places and Numbers

What different kinds of plants and animals do you think you would find in a desert and a jungle? In which area do you think you would find the largest number of each kind?

People who study ecology are very interested in knowing how many plants and animals of each different kind live in the same area. This is the study of *populations*. This information helps us to understand more about each environment and the things that live there.

Sometimes the populations of different plants or animals change. People who study ecology try to find out why this happens, because this change may be harmful.

In the following activities you will learn more about these ideas and you will see how the things people do very often affect the population of living things.

Activity 1:

What makes up your community?

You live in a neighborhood. Your neighborhood and the other neighborhoods around it form what is called a *community*.

A community has boundaries. Can you name some of the streets, highways, rivers, or other landmarks that form the boundaries of your community?

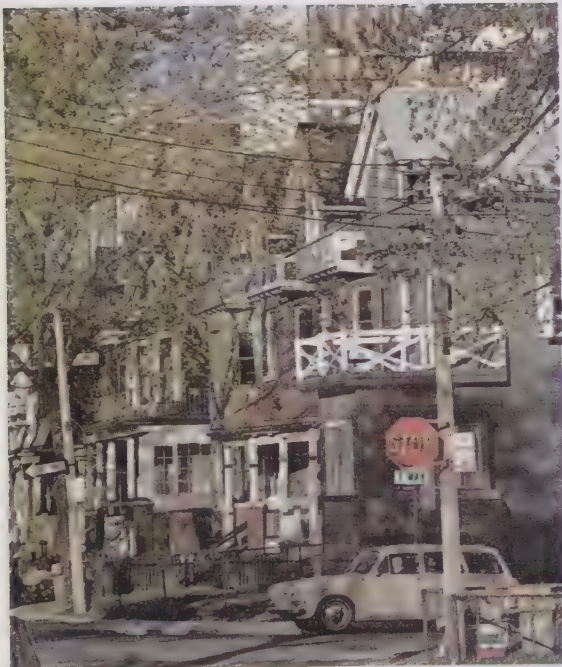
Look at a map and try to find some of the boundaries of your community. Use the map to help you to sketch the shape of your community.

Your community has buildings in it. List some of the kinds of buildings found in your community.

What are some kinds of buildings not found in a city community? What do you think would be the differences in the buildings you find in a city and a farm community? A factory and a residential community? An older and a newer community?

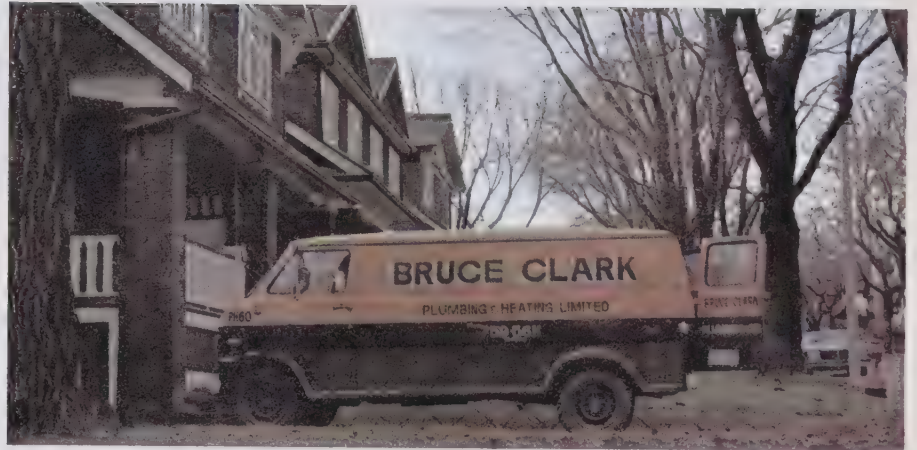


In which type of community would you find the buildings shown on these pages?





What jobs do the people who drive these trucks do? Which of these workers might visit your community?



There are many kinds of workers in your community. List some of the jobs that the people who live in your community do.

Did your list include homemakers and pupils as well as factory workers and letter carriers? How does each type of worker that you listed help your community? Why are there very few farmers or fishermen in a city community?





What differences can you find in each of these small communities?

Animals live in your community also. Which animals in this list are not found in your community?

cats	squirrels	monkeys
dogs	robins	sharks
flies	eagles	tuna
snakes	bears	bass
elephants	mice	trout
cows	crows	goldfish
deer	bees	moose

Why are some of these animals not found in your community?

Plants also live in your community. Which of the following plants are not found in your community?

maple trees	wheat	orchids
corn	tulips	apple trees
roses	palm trees	cacti
elm trees	orange trees	dandelions

Why are some of these plants not found in your community?

A large community can have smaller communities in it. There are many smaller communities within your community. Plants and animals, rather than people, often live in these smaller communities. Each small community has its own special plant and animal population.

People who study ecology think of the lawn, the garden, and the fencerow as

small communities. What other small communities might be found in your area?

Look at several communities that you can find in your neighborhood. For each community that you examine write:

- a description of its boundaries
- a list of the animal populations you see
- a list of the plant populations living there
- a list of the different conditions that you find. (Is it sunny or shady, wet or dry, windy or calm, open or sheltered?)

Record your findings in a chart like the one shown.



Small Communities in Our Neighborhood				
Type of Small Communities	Boundaries	Animal Populations	Plant Populations	Conditions
Lawn	house fence driveway sidewalk	ants worms	grass dandelions clover	flat ground moisture sunlight good soil
Garden				



Digging Deeper

What was the smallest community that you found? The largest?

How many small communities did you find within your large community?

Which small community had the largest number of animal populations? Plant populations?

Which small communities had the same kinds of populations in them?

Which small community was the driest? The wettest? Which small community received the most sunlight? The least sunlight?

Write down what you think a community is. Compare your explanation with that of other pupils. Is a community the groups of things that live there or the place where they live?

How would you explain the difference between the words *community* and *environment*?

Branching Out

People who study ecology (*ecologists*) have divided the world into many kinds of communities. Some of these communities are shown in the photographs on this page. List some of the populations and some of the conditions you would expect to find in each community.



Give a name to each of these larger communities. What populations and conditions might be found in them?

What populations and conditions might be found in the tundra?



Activity 2:

What are some groups of living things found in your community?

Count the number of pupils in your classroom. This number is called its *population*. What is the population of your school? What is the population of your town or city?

Your environment has populations of other living things besides people in it. In studying ecology, whole populations of living things are looked at rather than just one member of a population.

Make a list of some of the living things that might have populations in your community. Walk around the block with your list. Cross off any items you do not find. Add items to the list that you have overlooked. Some plants and animals you might list are:

dogs	tulips
cats	dandelions
squirrels	butterflies
people	ants
oak trees	grasshoppers
maple trees	spiders
pine trees	sparrows
willow trees	starlings

Select one of the living things from your list. Walk around the block again with a partner and count the number of that kind of living thing that you see.

Other teams of partners could count other things from their list. When you go back to the classroom, make a chart like the one shown about the populations that were counted.



What does this sign tell you about this community?

Which plant population are these students counting?



Populations in Our Community				
Teams	Plant		Animal	
	Kind	Number	Kind	Number
Maria and Tom	maple trees	38		
John and Kim			Squirrels	12
Tanya and Jean	pine trees	16		
Jim and Brigitte			dogs	6

Digging Deeper

What was the largest population that anyone in your class counted? The smallest?

For which living things did you count only a part of the population? Which populations would be impossible to measure by just counting?

How would you count squirrel populations if you found that there were two or more kinds of squirrels in your community?

Why are groups of houses, cars, rocks, or streets not populations?

Branching Out

People who study ecology try to find out how one population of living things can affect or change another population. Look at the lists of populations below. What effects do you think a population from List A has on the matching population from List B?

HOW POPULATIONS AFFECT ONE ANOTHER	
LIST A	LIST B
robins	worms in a lawn
tent caterpillars	trees along a street
mice	one cat
dandelions	grass plants in a lawn
wolves	deer
campers	forest plants



What could happen to the populations in List B if the populations in List A suddenly became very large?

What could happen to the populations in List A if the populations in List B suddenly became very large?

When do you think each pair of populations would be in balance? Explain your answer.

Can you accurately count an ant population such as this? Why?

Activity 3:

Can a piece of land have too many living things on it?

How many pupils are in your classroom? Suppose that the number of pupils was doubled. How would this overcrowding change affect you?

Would you bump into people more often? How much floor space would you have to move around in? How much longer would it take to line up for recess or fire drill? How much more water would be needed for drinking and flushing toilets? How much more food would be needed for lunches?

Imagine what would happen to all of these things if the number of pupils were doubled again!

If you live in a farm community, you could think about a pasture large enough for ten cows to get enough to eat in a few hours and spend the rest of the day resting.

Suppose that the farmer thinks his cows are doing well and adds ten more to his herd. After a short while the grass in the pasture may become very closely cropped, and the cows may have to graze all day in order to get enough to eat. Soon spots of bare earth may appear in the pasture and the cows may begin to look very thin.

A piece of land can supply only enough food, water and shelter to look after just so many animals and plants. This is called the *carrying capacity* of the land.

The carrying capacity of the land helps to limit or control the population of plants or animals that can live on it.

To find out how the carrying capacity limits plant growth, try an experiment by planting some bean seeds in two flower pots.

Make sure that the flower pots are the same size and shape and made of the same material. Try to put the same kind and amount of soil into each pot.

Place the pots on a window ledge where each will receive the same amount of sunlight. Give each pot the same amount of water.

Change only one thing at a time and keep the rest the same in order to make the experiment fair.

In one pot plant three to five bean seeds. In the second pot plant thirty or



forty bean seeds. The number of bean seeds is the only thing that should be changed. If you can't get bean seeds, use radish seeds or another kind of fast-growing seed. Label one pot "A", and the other pot "B".

When the bean plants begin to appear, start to fill in a chart like the one shown.

If you see any other differences between the plants in the two pots, add these to your chart.

Which pot do you think will have the healthiest bean plants? Why?

You might find it necessary to observe the bean plants for more than three weeks.

Result of The Bean Plant Experiment						
	First Week		Second Week		Third Week	
	Pot A	Pot B	Pot A	Pot B	Pot A	Pot B
Number of Plants That Grew						
Height of Tallest Plants						
Average Number of Leaves.						
Color of Plants						
Number of Plants Still Alive						

Where does the oriole spend the summer and the winter? How far does this bird migrate?

Digging Deeper

Would planting the seeds at different depths in the pots be fair? What other things should be kept the same when planting and growing your seeds?

In which pot did the seeds start to grow first? In which pot did the plants grow the tallest? Which pot had the healthiest plants? In which pot did the plants start to die first?

In which pot did each plant have the most food, water, sunlight, and room to grow? Why do you think the plants in one pot grew differently from those in the other?

How could the words *overpopulation* and *carrying capacity* be used to describe what happened to the bean plants after three weeks?



Branching Out

In the spring, male birds often *migrate* or fly to their nesting ground before the female birds. When they arrive, they find a suitable place to nest.

The nest must be in an area that will supply enough food for the parent birds and their young. This area is called a *territory*.

The male announces where the boundaries of his territory are by singing heartily from various places at its edges. If another male of the same kind crosses the boundary lines, there is often a fight and the stranger is chased away. In this way, each bird prevents its territory from being overpopulated and the balance of nature is kept.

Does a dog have a territory with boundaries? What does he do to strangers who visit his home ground?

These Canada geese are nesting. What do you think might happen if you approached the nest too closely?



Is there an overpopulation of deer shown in these photographs? Why?

Read the following story to find out what can happen when man makes changes in natural populations.

Many years ago an area was set up as a game preserve for deer. All the *predators* that ate the deer, such as wolves, coyotes, bobcats, cougars, and bears were killed. No cattle grazing or hunting of deer was allowed. In eighteen years the deer population had increased from 4000 to 100 000. Then something happened. Shrubs became sickly, the lower branches of the trees were eaten off, and so were *saplings*, or young trees. In the next six years, 80 000 deer starved to death.

What does this tell you about carrying capacity and overpopulation?

How do predators help to control carrying capacity?

What nonliving things might change the carrying capacity of an area from year to year?

Many scientists believe that the carrying capacity of the earth for human population has been exceeded. They believe the earth cannot produce enough food for all its population. In fact, many people in our world are prevented from starving only because food is sent to them from other countries.



How does drought change the carrying capacity of an area?

Test the carrying capacity of your community by answering the following questions.

What would you eat if you had to eat only those things grown in your community?

What would you wear if you could use only those materials found nearby?

What would you use for fuel or for building materials?

How do you think your life would be changed? Could you survive?



4. Living Together

Have you ever been bitten by a mosquito? Why do you think some mosquitoes 'bite' people?

When mosquitoes 'bite' people or other animals, they sip the blood of their victim. Certain mosquitoes could not survive without this blood. There is a *relationship* or connection between mosquitoes and certain animals.

There are many other kinds of relationships among plants and animals that live in the same environment. As you do the following activities you will find that you yourself are a part of many of these relationships.



What is the relationship between the mosquito and its victim?

and the owners of these buildings. How many businesses and how many types of jobs belonging to this relationship can you list for your community?

A relationship has two parts. For example, what does the customer give the storekeeper in return for the things that he sells? Since the storekeeper depends on his customers and the customers depend on the storekeeper, they are said to be *interrelated*, or that there is an *interrelationship* between them.

Activity 1:

What kinds of interrelationships are found in plant and animal communities?

In your community there are many *relationships* between people who live and work there. For example, there is a relationship between the people who supply food and those who eat that food.

Make a list of all the kinds of stores and the kinds of jobs people do to supply food in your community.

In ecology, suppliers of food are called *producers*, and eaters of food are known as *consumers*.

There are other relationships in your community. For example, between the people who supply the materials for building homes, factories, and offices



What things must be done with milk before it reaches you?





Many kinds of jobs in your community are called *services*. Letter carriers, repairmen, cleaners, gardeners, deliverymen, and fire fighters all come to your home and provide some kind of help when needed. What kinds of interrelationships do these helpers have with the homeowner and with other people?

There are many other kinds of interrelationships that occur in your community. List as many as you can think of.

When both parts of an interrelationship help each other, then the interrelationship is said to be helpful or *beneficial*. Sometimes a relationship is beneficial to only one of the parts, and may be harmful to the other.

Interrelationships are very important in the study of ecology. Interrelationships take place between plants and animals as well as between people. Interrelationships also take place between plants, animals, and the environment.

You can see some plant-animal-environment interrelationships in your own community. Look carefully at some of the following examples:

- small creatures under an old board or a rock
- the ground under an evergreen tree
- a spider and its web
- plants whose leaves have holes in them

What kinds of interrelationships are shown in these photographs?



- trees with green algae, lichens, or fungus on them
- places where people have trampled the grass
- flowers being visited by insects
- a lawn with weeds growing in it
- the grass very close to a building

What kind of interrelationship can you see in this photograph?



What interrelationships among plants, animals or the environment can you find in each picture?



Interrelationships in Small Communities		
What We Looked At	Description of Interrelationship	Type of Interrelationship
Leaves with Holes in Them	Insect has been eating the leaves for food.	plant and animal
Small Creatures under a Rock	Insects and worms preferred dark, cool areas.	animal and environment
Spider and Web	Spider was catching flies.	animal and animal
Fungus on a Tree	The fungus lived on the tree and got its food from the tree.	plant and plant

With a partner, visit as many of these places as you can. Make a chart like the one shown above.

When ecologists study plant and animal communities they group the interrelationships into two main kinds. This is shown in the chart below.

KINDS OF INTERRELATIONSHIPS IN PLANT AND ANIMAL COMMUNITIES	
LIVING AND LIVING	LIVING AND NONLIVING
1. Animals and animals	1. Animals and the environment (light, moisture, air, wind)
2. Animals and plants	2. Plants and the environment (light, moisture, soil, drainage)
3. Plants and plants	



Digging Deeper

Why does your community need police officers, dogcatchers, and lawyers?

Which of the plants or small communities that you looked at had interrelationships between living things? Which ones had interrelationships between living and nonliving things?

Which interrelationships were between animal and animal? Animal and plant? Plant and plant?

Which interrelationships were beneficial to both parts? To only one of the parts? In which interrelationship was water an important part?

In which interrelationship was the amount of sunlight or shade one of the parts?



Branching Out

Some interrelationships are very common, but some are rather unusual. Try to find the meanings of these kinds of interrelationships in a dictionary or encyclopedia: *symbiosis*, *commensalism*, *parasitism*. Match these words with the photographs on this page.

Ask your teacher or librarian to help you find books where you can find out what effect the partners in each of the relationships shown have on each other.

What three different kinds of interrelationships are shown in these pictures?



What are the producer-consumer interrelationships in each of the photographs on these pages?



Activity 2:

What are some interrelationships that have to do with feeding?

In your community the people who make or grow things are called *producers*. What they make or grow are their *products*. Make a list of some of the producers in your community.

The people who use or buy the producers' products are called *consumers*. List some of the ways in which you are a consumer and list some of the products you have used.

In plant and animal communities there are producers and consumers too. These plant and animal producers and consumers have interrelationships. Ecologists study producer-consumer interrelationships.

Make a chart like the one shown. Fill in the blank spaces to show how the producers and consumers are interrelated. Some spaces in the chart have been left for you to think of producer-consumer interrelationships entirely on your own.



Producer - Consumer Interrelationships			
Producers		Consumers	
Type of Plant or Animal	What it produces	Type of Plant or Animal	What it consumes
fly	food for spider	fly	cookie crumbs
grass	food for grasshopper	grass	water
grasshopper		grasshopper	grass
	air and water	cow	grass
		people	
large fish		minnow	
		hawk	
deer			

Which animals in these photographs are predators?



Digging Deeper

How many examples did you find in which grass was a producer? How is grass also a consumer?

What examples did you find in which birds were consumers?

Is it possible for a plant or an animal to be both a producer and a consumer? Explain your answer.

What living things in your environment are *not* both consumers and producers?

What plants or animals *not* found in your environment have a producer-consumer interrelationship?

Branching Out

Consumers that eat other animals in order to live are called *predators*. How are you a predator? What animals in the chart were predators?

What would happen in an interrelationship if there were more predators than producers? What would happen in an interrelationship if the predators were removed?

Why should farmers not shoot hawks even though they might eat some chickens?

What happens to the deer population when all the wolves are killed?

"Frogs eat insects and this relationship is also helpful for people. But snakes eat frogs, so snakes are harmful. Therefore people should kill snakes." Do you think this is a good argument? Explain your answer.

Activity 3:

How is an aquarium like an ecosystem?

If you made an aquarium in Chapter Two you found out that it had many living and nonliving parts. In this water community, what interrelationships are there between the living and nonliving things?

To answer this question, first carefully observe your aquarium. Now list the living and nonliving parts in the columns of a chart like the one shown below.

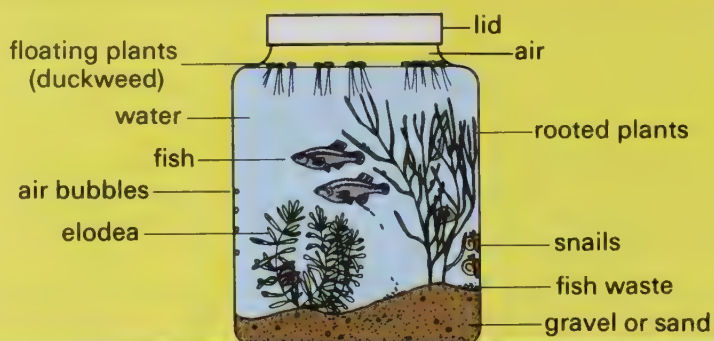
Interrelationships Between The Living and Nonliving Parts of an Aquarium		
Living Part	Nonliving Part	Interrelationship
1. fish	water	swimming breathing
2.		
3.		
4.		
5.		

How do you think the parts that you listed might be interrelated? Write your answers in the "interrelationships" column of your chart.

So far, you have discovered interrelationships between living and nonliving things. What other kind of interrelationships are there?

Interrelationships exist between living things and other living things, and between nonliving things and other nonliving things.

SOME PARTS OF AN AQUARIUM



Examples of interrelationships between nonliving things and other nonliving things may be harder for you to observe. Some examples are water and sun which can make clouds, or water and low temperatures which can cause ice to form.

Use charts similar to the one you just completed to show examples of interrelationships between living things and other living things, and between nonliving things and other nonliving things in your aquarium.

What interrelationships can you find among the parts that make up this water community?

Do you agree with the interrelationships on these charts? Can you add others?

Interrelationships Between the Living Parts of the Aquarium		
One Living Part	Other Living Part	Interrelationship
1. fish	snails	snails remove fish waste
2.		
3.		
4.		

Interrelationships Between the Nonliving Parts of the Aquarium		
One Nonliving Part	Other Nonliving Part	Interrelationship
1. water	air	air dissolves in water
2.		
3.		
4.		

Why are these ecosystems no longer balanced? Can you think of other ecosystems that are no longer in balance?

How many kinds of interrelationships among the parts in the aquarium did you find?

How many interrelationships involved both living and nonliving things?

Is your aquarium an ecosystem? Why?

Study the charts that you have made and place a "C" beside each consumer that you have listed. Place a "P" beside each producer. In an ecosystem, can a living or nonliving thing be both a producer and a consumer? Explain your answer.

What predators can you find in your aquarium ecosystem?



Branching Out

When an ecosystem is balanced like a teeter-totter, all parts are working well. Sometimes an ecosystem becomes unbalanced and some of the parts stop working well.

A simple test to find out if your aquarium ecosystem is balanced is to remove the cap and smell the water. Does it have a pleasing smell or a bad smell? What will the smell tell you about the balance in your ecosystem?

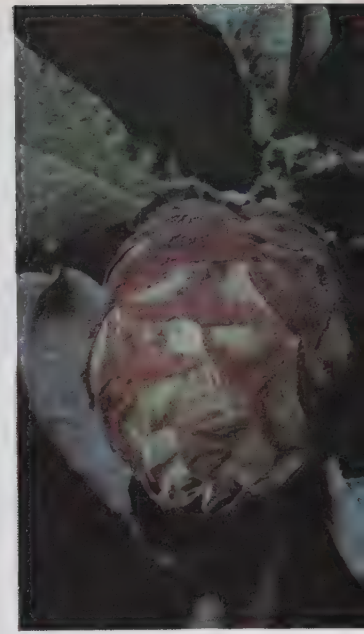
Study the photographs of ecosystems on this page. These ecosystems are no longer balanced. Make a chart like the one shown and fill in the reasons why you think the ecosystems are not balanced.

Ecosystems That Are No Longer Balanced		
Ecosystem	How the Ecosystem Is Not in Balance	Reason
1.		
2.		
3.		



One kind of goldenrod gall.

One kind of oak gall.



Activity 4:

What kind of interrelationship can be found in plant galls?

A green little world
With me at its heart!
A house grown by magic,
Of a green stem, a part.

My walls give me food
And protect me from foes,
I eat at my leisure,
In safety repose.

My house hath no window,
'Tis dark as the night.
But I make me a door
And batten it tight.

And when my wings grow
I throw wide my door;
And to my green castle
I return nevermore.

Anna Botsford Comstock

Galls are really places where an insect lives and grows. Each different insect causes galls to appear on its own special plant and lives in its own special type of gall.

The gall insect obtains its food and shelter from the plant without returning anything to the plant. This type of relationship is called *parasitism*. The animal living off the plant is called a *parasite*.

This gall is found on certain willow trees. Why do you think it is called a "pine cone" gall?

One kind of maple gall.



Have you ever noticed unusual swellings on the leaves and stems of the plants growing in fields or vacant lots near your home or school? Many of these lumps are probably *galls*. What do you think causes galls? Read the above poem once again. Can you think of a good title for it?

What information about these galls should be added to your chart?

Activity 4(a):

Where can you find galls in your community?

Some good places to look for galls are in vacant lots, along fences, or in fields where there are long grasses. Goldenrod galls are especially easy to find. You can also find galls on oak, maple, and willow trees.

Galls start to form in the spring, but the best time to look for them is in the early fall when they are larger and fully formed.

Collect as many galls as you can. Fill in a chart like the one shown for each type that you find.

Place the galls in a plastic bag. This will keep them in good condition so you can study them later.



Where Galls Were Found			
Name of Plant	Plant Part Where Galls Were Found	Location of Gall on Plant Part	Number of Galls on Plant
Goldenrod # 1	stem	near top of stem	1
Goldenrod #2	stem	near top of stem	2
Maple #1	leaf	upper part	5
Goldenrod #3			

Digging Deeper

On what part of a plant did you find most galls? On the stem? Leaves? Flower? Fruit?

What was the largest number of galls you found on any one plant?

If the galls were found on the leaf of the plant, did all the leaves have galls on them?

Did you find more galls in sunny places or shaded places? In open spaces or crowded places?

Did you find more than one kind of gall on any one plant?

Can the same kind of gall have a different size or shape?



One kind of gall found on wild rose plants.



Activity 4(b):

What is inside a gall?

Use a very sharp penknife, paring knife, or taped razor blade and carefully cut open one of each kind of gall that you collected. If you have several samples cut open more than one of each type. You may need to use a magnifying glass to see what is inside some very small galls.

Make a chart like the one shown. For each gall you cut open, answer these questions:

- Is there a space inside? How thick are the walls?
- Is there a tunnel? Where does it go?
- Is there a neat round hole or doorway outside? Does the gall have an open door?
- Is there an insect inside? Where is it?
- Is the insect in the worm or larva stage?
- Could the empty galls have had insects in them? Did any galls have more than one insect in them?

Comparing What's Inside Galls			
Plant Where Gall Was Found	Description of Gall		Description and Number of Larvae Found Inside
	Size, Shape, Hardness Thickness of Wall	Door, Direction and Length of Tunnel	
1.			
2.			
3.			
4.			

The mother insect lays her eggs under the skin of some part of the plant. When the larva hatches it begins to eat the plant. At the same time, the larva gives off a chemical that makes the part of the plant around it grow faster so that a swelling grows. This swelling becomes the gall.

When the larva is ready to become a pupa, it makes a tunnel. In the tunnel it changes into an insect like its mother. It eats through the plant wall to make a doorway and flies away to lay eggs on another plant.

A chart like this one will help you to keep a record of what you observed.

What you might find in different kinds of galls.



Digging Deeper

How many galls with tunnels and open doors had insects inside them? Did the insect use the tunnel door to enter or to leave the gall?

What name is given to the interrelationship between a larva and a plant?

Why could the gall be called a mini-habitat?

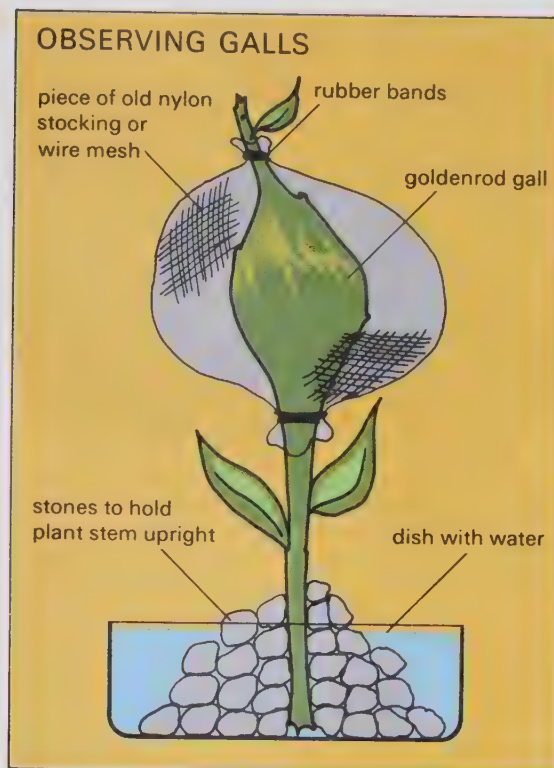
Activity 4(c):

What types of insects cause galls?

Most galls are caused by insects. Some of the kinds of insects that make galls are flies, moths, aphids, and wasps. Each kind of insect makes a different shape of gall. For example, oak leaves can have more than three hundred kinds of galls on them.

Look at the larvae inside the galls you found. Use the following chart to help you place the galls into one of these four main groups.

FOUR TYPES OF GALLS		
GROUP NUMBER	NAME OF GROUP	DESCRIPTION OF LARVAE INSIDE
1.	Aphid Galls	The larvae in these galls have well-developed legs and antennae or feelers. There are several larvae in each gall.
2.	Moth Galls	These larvae are like caterpillars. Their cigar-shaped galls are often found on the stems of ragweed or goldenrod and contain only one larva.
3.	Fly Galls	The larvae in these galls look like maggots or little white grubs. Round goldenrod galls usually contain one of these larvae.
4.	Wasp Galls	These larvae resemble small caterpillars. There is usually only one larva in each gall. The galls are found on oak trees, and certain ones are called "oak apples".

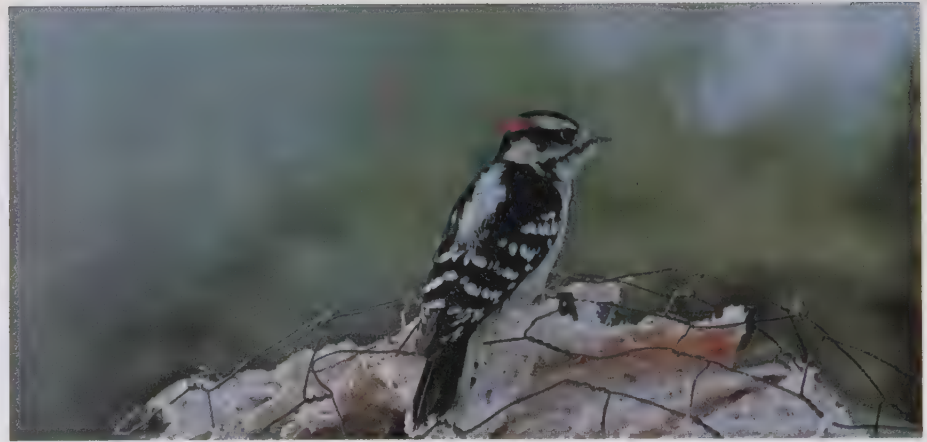


You can observe galls to find out what kind of insect comes out by following the suggestions in this diagram.

How can you find out what kind of insect comes out of the gall? Examine the galls you have collected to make sure that the door is not open and the insect is still inside. Place the stem of the gall in water. Surround the gall with a nylon net as shown in the diagram. Keep the galls in a cool place. Watch for the adult insect to come out. It will take from four to six weeks.

This gall fly makes its own special kind of gall.





Did some of the goldenrod galls you collected have rough, ragged holes in them? What do you think might have made these holes?

The little worms in goldenrod galls are a favorite food of the downy woodpecker. He sits on a gall and taps with his bill until a hollow sound tells him he has found the tunnel. He then opens up the gall and eats the insect inside.

Digging Deeper

Did you find more of one type of gall? What was the most common? The rarest?

What kind of relationship does the downy woodpecker have with the insects in goldenrod galls?

What special feature does the woodpecker have that helps it to reach the insect inside the gall?

Most galls are caused by insects. What other things can cause galls? Look in books in your local or school library to find how many other things can cause galls to form on plants.

Now read the poem at the beginning of this activity again. From what you have learned about galls, can you find two or three places where the poet was not quite correct?

Branching Out

WHAT PEOPLE USED TO THINK ABOUT GALLS

There have been many strange stories and beliefs about galls since Roman times. The Romans based some of their prophecies or predictions on whether a gall contained a spider, a worm, or a fly. Later, in seventeenth-century Italy, the growing interest in science led to two theories about galls.

A physician called Redi (*ray-dee*) believed that the plant had a vegetable soul which produced galls. The eggs and larvae in the galls then gave birth to flowers and seeds.

A little later, the biologist Malpighi (*mall-pee-gee*) realized that galls occurred after insects had made a hole in the plant tissues. He believed that the plant swelled as we do when we are stung by a bee or wasp. He was possibly very near the truth.

By the eighteenth century, some scientists believed that plants developed galls in order to have insects at hand to pollinate their flowers.

Look up reference books from your school or local library to see if you can find out anything else about these scientists and what they thought about galls.

What kind of interrelationship is there between the downy woodpecker and goldenrod galls?

Many galls are attacked by other parasites which also feed on the plant. Sometimes they even eat the larvae inside the gall.

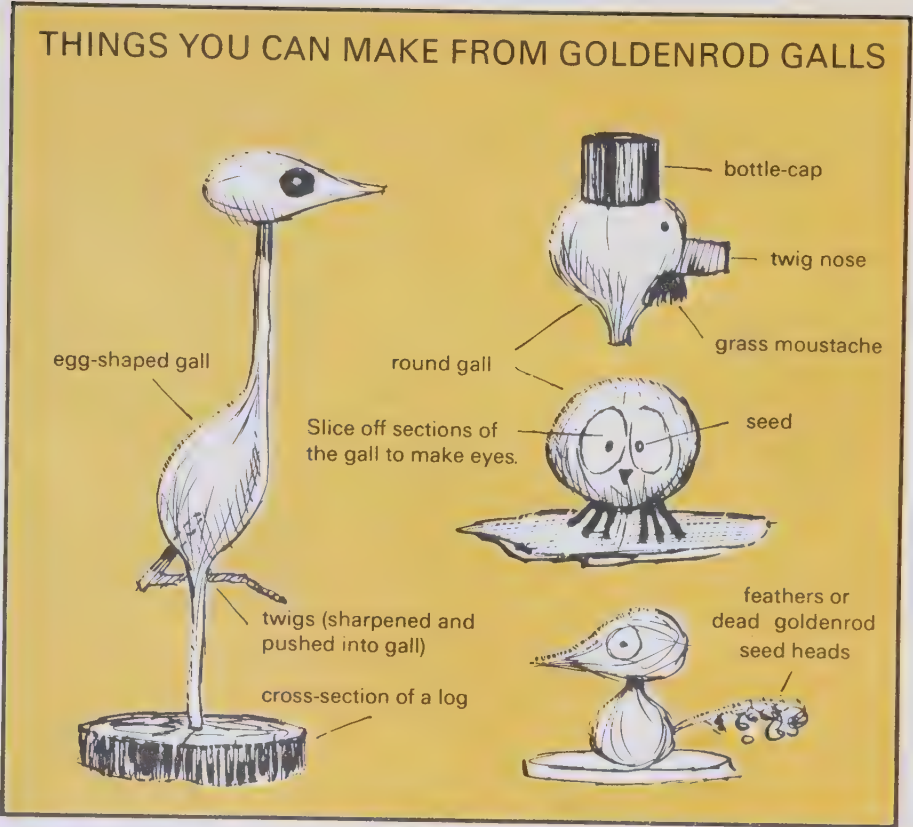


What other things can you make with galls?

MAKING MODELS FROM GALLS

When you have finished the other activities with your galls, you can try to make things with them. Goldenrod galls are especially good for this. Try using other natural materials such as seeds, bark, twigs, and feathers to complete your models.

Join the galls together with sharpened twigs or stick them together with glue. You could make birds, animal heads, and many other things. Here are some suggestions. Try and think of some new ideas that you could make with the galls you have already found.



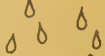
Activity 5:
Where does your food come from?

Collect several magazines and newspapers with pictures and advertisements for food in them. Make a lunch menu by cutting out pictures of your favorite foods.

Choose one of the pictures and put it in the proper place on a chart like the one shown.

Draw or cut out pictures to fill in the rest of the chart. As you move up the column on the chart there should be a relationship between each of the things in the pictures. Do this for several foods that you enjoy.

On the chart, you have traced your favorite foods back to their *source*, and shown the relationships. Each column in the chart shows what is called a *food chain*.

Where My Food Comes From			
			
Conditions	 water		
What Food Source Feeds on	 soil		
Source of Food	 potatoes		
One Favorite Food	 potato chips		
Me			

These students are making their own chart to show food chains.



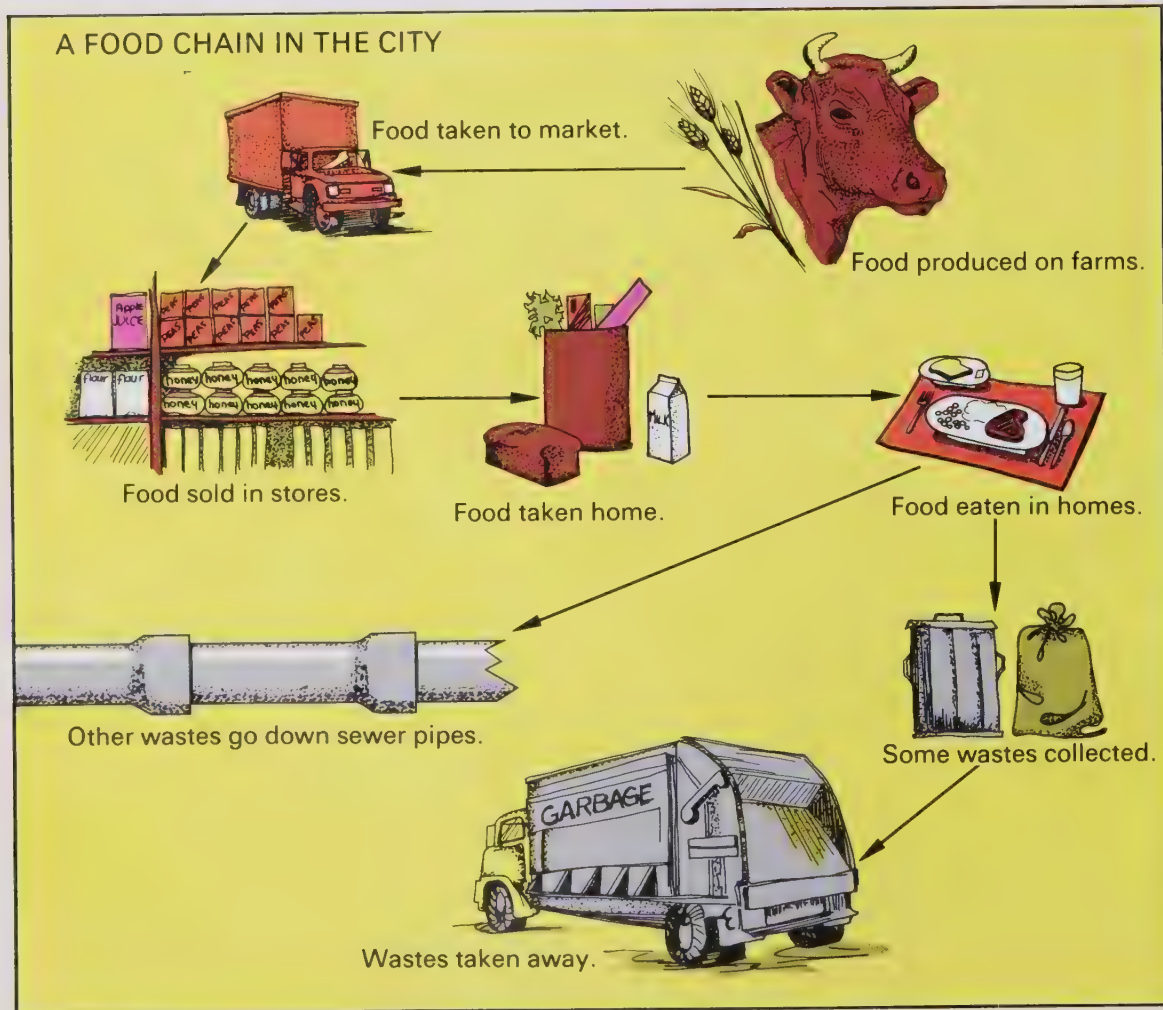
Digging Deeper

How many links are there for each food chain on your chart?

Why is a person at the end of each food chain?

Why do your favorite foods need the sun's energy?

Draw pictures showing food chains for eggs, bacon, hamburger, and milkshakes.



This diagram shows some of the links in a food chain in the city.

List as many food chains as you can in which both you and chickens are members.



Branching Out

Study this diagram of one kind of pond food chain.

How many links can you find in the chain?

Which are consumers in the chain? Which are producers?

What would happen if one link in the food chain was destroyed?

Study your aquarium ecosystem and draw a diagram of the food chain that you can observe.

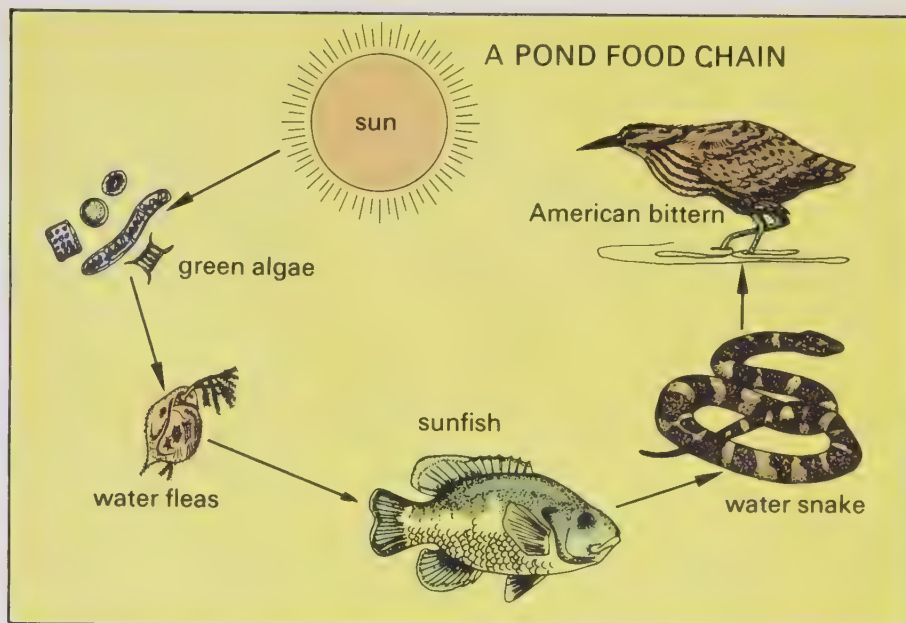
Here are some puzzles. Discuss how you might complete the blanks. Your answers might contain words such as *harmful*, *beneficial*, *good*, or *bad*, or even all of these together. Remember the balance of nature!

Trees are cut and used for lumber.

Trees are worth money.

Trees put oxygen back into the air.

— Therefore trees are ____.



Moth larvae eat leaves.

— Therefore moth larvae are ____.

Mice eat moth larvae.

— Therefore mice are ____.

Mice eat seedling trees.

— Therefore mice are ____.

Hawks eat mice.

— Therefore hawks are ____.

If mice are good then hawks are ____.

If mice are bad then hawks are ____.

— Are hawks good or bad?

Describe the interrelationships you see in this diagram of a pond food chain.

Why do hawks kill other animals? Is this harmful or beneficial when you think of ecology? Explain your answer.



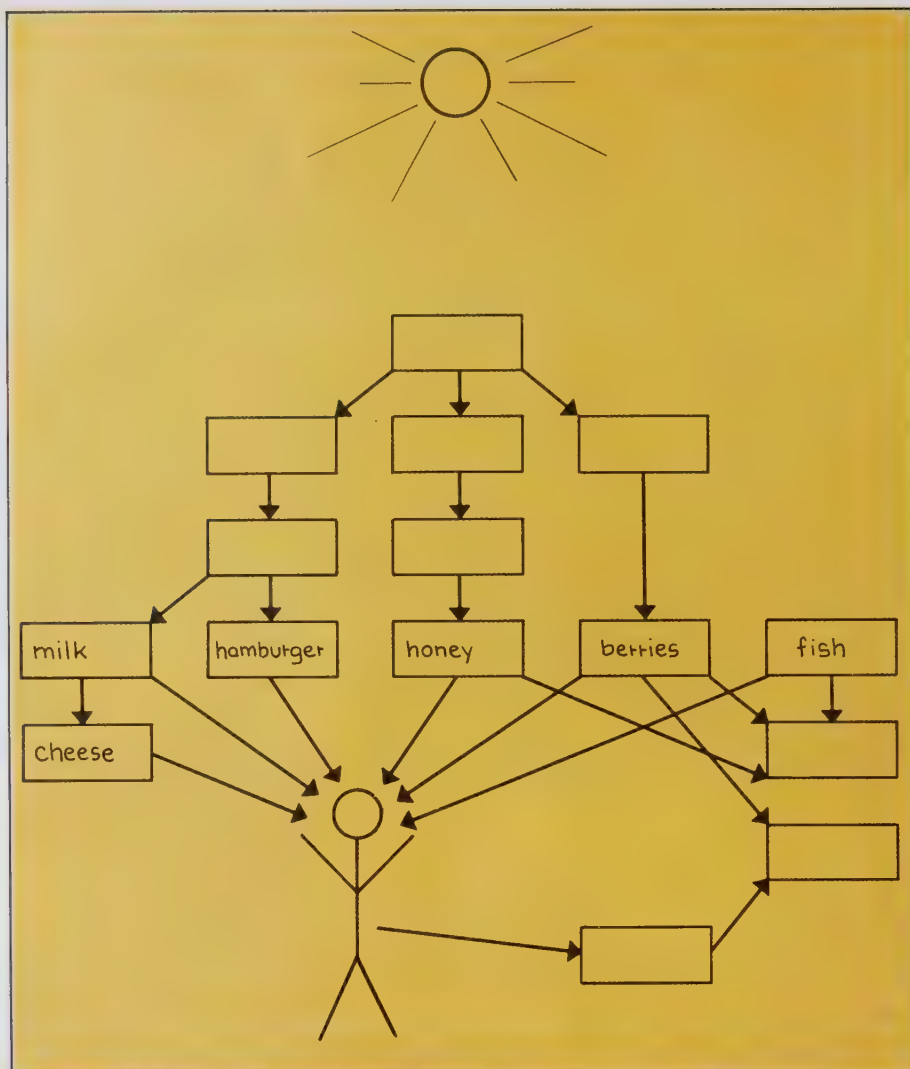
Activity 6:

What happens when you are a link in many different food chains?

Make a diagram like the one shown. Now take each of the foods, and fill in the empty boxes with the links in the food chain. Follow the arrows to find the food chain for that particular food.

You are one link in many food chains. Other animals and plants belong to several food chains too. Different food chains overlap or are connected because plants and animals in one chain depend on plants and animals in another chain for food. This makes a much more confusing picture.

All these overlapping food chains are called a *food web*. The food web is made up of many food chains and shows the interrelationships of all the producers and consumers in one environment.



Make a chart like this one and complete each food chain.

List as many food chains as you can that are involved in this meal.

How important is the frog to the food web in a pond? Is the frog more important or less important than the bittern? Why?

Digging Deeper

Which is the least important member of the food web that you completed? Explain your answer. What would happen if that member were not there?

What is the most important member of the food web? Why? What would happen if that member were not there?

What would happen if some animals had no natural enemies?

How can people sometimes disturb food webs through fire, erosion, or insecticides? Can they destroy food webs by clearing land for houses, overcutting forests, or draining swamps? Explain how.

How can people help to protect the balance of nature in food webs?

How important are people in the balance of nature?

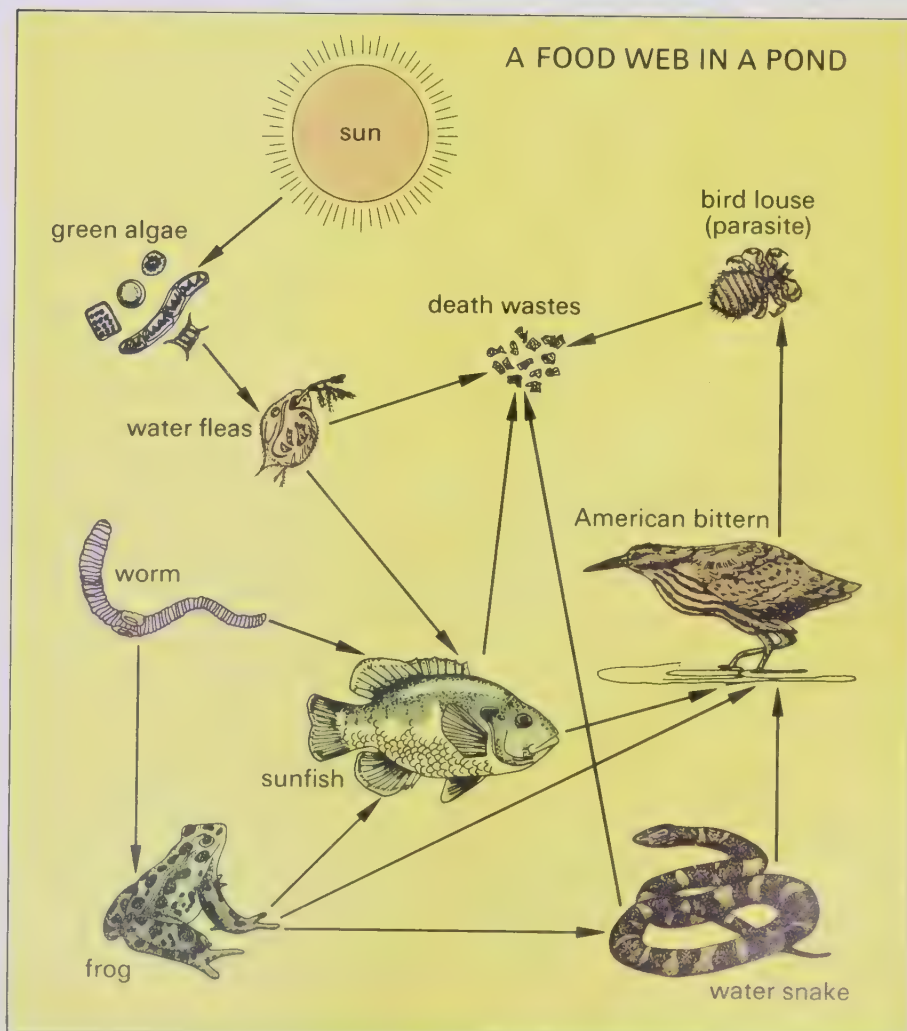
Branching Out

Study the diagram of a food web in a pond.

Compare this food web to the food chain in a pond shown in *Activity 5*. How many chains can you find in each diagram? How many plants and animals can you find in each diagram? How many consumers and producers can you find in each diagram?

Why is the food web a better way of showing what really happens in a pond?

List as many things as you can that might cause an imbalance in the food web. How might an imbalance in the food web affect life in the pond?





How are these two animals interrelated in a food web?

There are many different types of food webs. Here is how you can make a diagram of a food web in a land environment.

Make a series of cards with the name and a picture of each of these plants and animals:

green leaves	mouse
ants and beetles	robin
fox	flies
squirrel	blue jay
garter snake	earthworm
moldy leaves	oak tree
owl	crow
raccoon	caterpillar
berries and nuts	spider

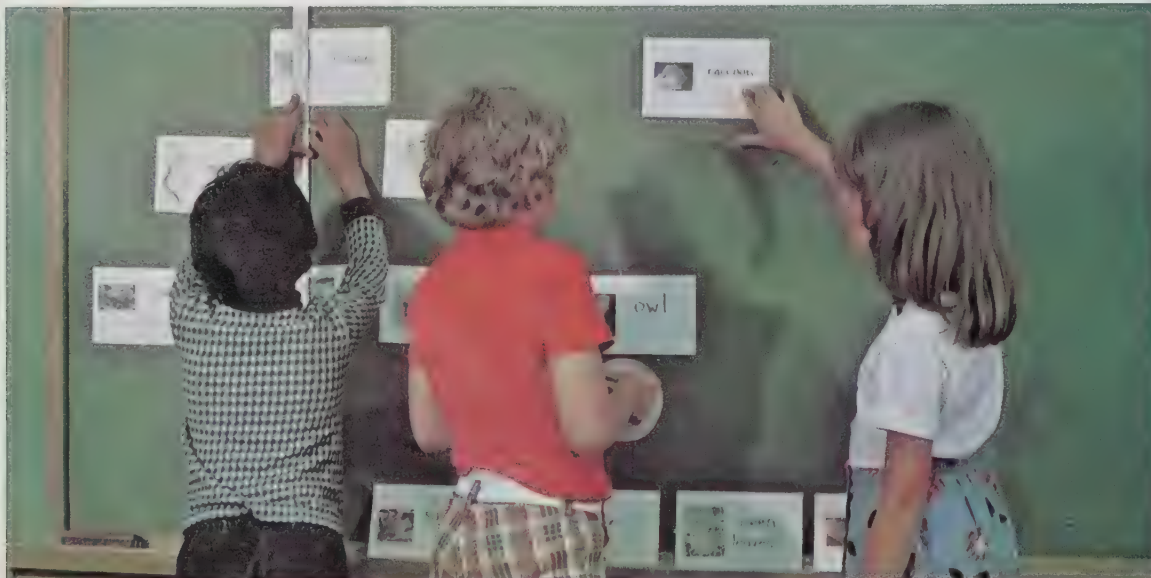
Each plant or animal in the list is a link in a food chain. Place the labeled pictures on the chalkboard or bulletin board. Now draw arrows to show what each plant or animal might depend on for food.

One food chain could be:

green leaves → caterpillar → mouse → snake

The caterpillar could also be eaten by the robin which might be eaten by the snake.

Complete the other food chains. Are you producing a food web as more and more of the food chains are completed?



A food web shows the interrelationships of more than one food chain in an environment.



5. Special Features

When you think of all the different kinds of plants and animals in a community, have you ever wondered how they all manage to get enough food?

Animals and plants are able to stay alive because they have developed certain parts of their bodies or have found special ways of doing things. These special features allow them to eat certain foods, live in certain habitats or protect themselves in a certain way.

Mountain lions or grizzly bears do not need to fear other animals, but how do you think rabbits, gophers and beavers are able to protect themselves?

In the following activities you will find out other special features which will help you to understand better how living things are suited to their environment.

Activity 1:

How are some plants and animals suited to live in their environment?

Most animals do not have thumbs as you do. You use your thumbs for many different things without realizing it.

Use adhesive tape to tape your thumbs to the palms of your hands so that you can no longer use your thumbs. Now try to pick up things from the floor, turn the pages of a book, sort small objects into piles, or write your name.

Untape your thumbs and write a short paragraph about what it would be like not to have thumbs.



How many tools can you think of that you could not use if you had no thumbs? What articles of clothing would have to be changed? Would we be able to use buttons, zippers and shoelaces?

Parts of our body, such as our thumbs, have developed in certain ways which help us get along better in our environment. This is called an *adaptation*. The way in which plants or animals are adapted to live in a certain environment is another important part of ecology.

Can you write as well when you cannot use your thumb?



In what way are some of the parts of some plants and animals different? Look at a pair of animals and a pair of plants selected from the following list.

- a dandelion and a plantain
- a maple tree and an evergreen tree
- a rose and a petunia
- an earthworm and a caterpillar
- a grasshopper and a cricket
- an ant and a housefly
- a toad and a frog
- a dog and a squirrel

If you cannot find some of these plants or animals in your environment then choose others. For each pair list the parts of their bodies that you can see that are different. Now list what the plant or the animal can or cannot do because of these differences. Fill in a chart similar to the one shown.

Digging Deeper

Why are there many more dandelions in your community than petunias? How are dandelion seeds adapted for travelling long distances?



Plant and Animal Differences		
Type of Plant or Animal	One Body Part and How It Is Different	What the Plant or Animal Can or Cannot Do
1. ant	hard, smooth, wingless body	
2. housefly		
1. rose	long, thorny stem	
2. petunia		

What special adaptations are found on the stem of a rose plant that help prevent it from being disturbed by animals?

How is a squirrel's body specially suited for climbing trees? Why can a dog not climb a tree? How are cats adapted for tree climbing? Why do squirrels usually make their homes in trees while cats do not?

What color are grasshoppers? Why are they so hard to see until they move? What color is a cricket? Why is the cricket's color suitable for nighttime activities?

Activity 2:

Do different plants and animals live in different conditions?

Why do you think that a great many maple trees grow in Canada but banana trees do not?

The conditions in an environment, such as the temperature, the amount of rain, or the amount of sunshine, make it possible for certain plants or animals to live there. The way in which plants can meet these conditions in order to stay alive shows another kind of adaptation.

Do some research to find out how this pitcher plant has adapted to its living conditions.





Things We Found in Different Conditions					
Location	Conditions	Type of Animal Life	Number	Type of Plant Life	Number
lawn	dry sunny	ants worms small bugs	21 1 3	short grass dandelions	46 1
tall grass					
pavement					
flower bed					
under a tree					

To find out if different kinds of plants and animals live in places where there are different conditions, try the following. Bend a coathanger to form a square. Now put the square in two or more of the following places:

- over some short grass on a lawn
- over some tall grass in a vacant lot or beside a fence
- in the bottom of a ditch with some water in it
- on a paved area
- on a flower bed
- under an evergreen tree whose branches touch the ground

For each place carefully list and count every living thing you find inside the coathanger square.

Also list the nonliving conditions found in each place. Make a chart like the one shown to help you compare what you found.

Digging Deeper

In which place did you find the most animal life? The least?

In which places did you find the same kinds of animal life? The same amounts?

Were any two places exactly alike?

Which place was the driest? The wettest? Which place was the sunniest? The most sheltered? In which places were the conditions the most alike?

Which places had the fewest plants? The most?

If the conditions in a location were changed, what would happen to the plant and animal life in that place?

Why do you think there were more plants or animals in some places? Why were there different plants and animals in the different types of places?

Branching Out

Look at the photograph of a beetle. Why do you think this creature is called a *diving beetle*? What special adaptation can you see? How does this help the beetle to adapt to different conditions?

Can all birds fly? Read about the ostrich and the penguin. Could these birds fly at one time? What may have caused them to change?

Ask your librarian to help you find information about the dodo bird. Why are there no dodos today?

Will the same kinds of living things be found in other locations?

How is this diving beetle adapted to meet its living conditions?





Activity 3:

What are some ways that a fish is adapted to live in a water environment?

Use a hand lens to help you look at one of the larger guppies in your aquarium. If your guppies are too small then perhaps you could buy a goldfish from a pet shop or borrow one from a friend's aquarium at home. You could also look at large minnows from a pond.

Set up a proper home for the goldfish or minnows. Feed them commercial fish food from the pet store.

Observe your fish to try to find out how it is better fitted for living in water than you are.

Make a chart like the one shown and record your observations. Sometimes it may be better to draw what you see rather than to describe it in words.

Digging Deeper

Look at the drawing or description of the shapes in your chart. Which is the best adapted to move through the water, you or the fish? Give some reasons for your answer.

Look at the diagram of the fish on this page.

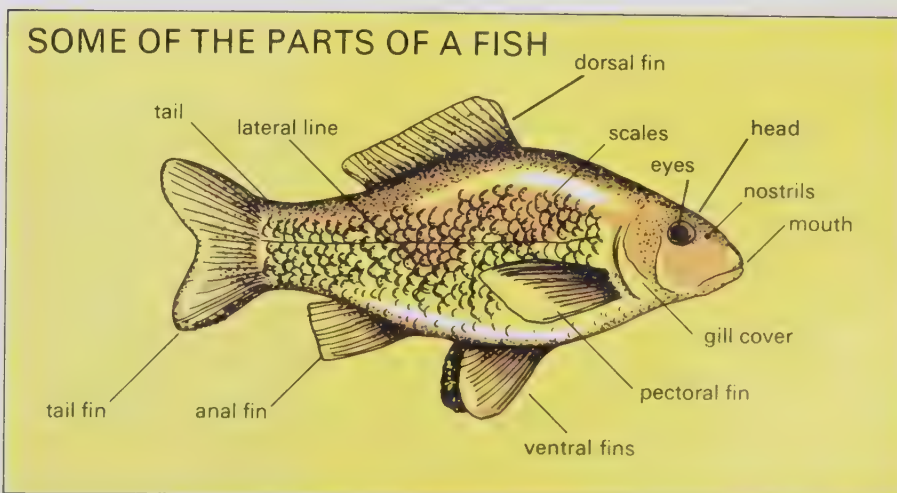
Which fins match your arms? Which ones match your legs? Which fins are extra?

How The Guppy Is Different From People		
Observation	Guppy	Me
Shape 1. from above 2. from the front 3. from the side		
Movements 1. parts used to move 2. kinds of movements		
Body Covering 1. kinds 2. color from above 3. color from below		
Senses 1. eyes 2. ears 3. nose		
Breathing 1. parts used for breathing 2. how they are used		
Feeding 1. parts used to get food 2. parts used to eat food		

Which fins are used for steering or balancing? Which fins help to push the fish through the water?

Why are your arms and hands not as good for swimming as fins? Why would the fish have trouble moving about on land?

Why is the fish better adapted to a water environment than you are?



How are the scales arranged on a fish's body? Do they overlap? How would this arrangement help in moving through water?

Does a fish have hair to protect its body? Why not?

How does your skin change if you sit in the bath for very long? Why is human skin not a good body covering for living in water?

If you have felt a fish you know that it is slippery. Why do you think this slippery substance is an important part of a fish's body covering?

Do fish seem to have large eyes? Is it darker in the water than it is on land? How do you think having larger eyes might help if you lived in the water?

Why might having larger eyes not be such a good thing for animals who live on land in bright sunlight?

Can you move your eyes? Your head? Can a fish move its head? Why does it have one eye on each side of its head?

Find the *lateral line* on the diagram of the fish. This line is its ears. Why do you think this kind of ear might be better for water than yours?

Did you see the fish's nostrils? Read some books in the library to find out if the fish uses its nostrils for smelling in the same way that you do.

When a fish breathes, through what parts of its body does the water enter and leave? What happens to the water it takes in? Read some books to see how a fish gets the air it needs out of the water. Why do people not have gill openings and coverings?

EXAMPLES OF STREAMLINING

CANOE



DOLPHIN



TORPEDO



RACING CAR

Would having hands and arms make it easier for a fish to get food? Would they be a disadvantage to a fish? Does a fish chew its food?

Branching Out

Look up the word *streamlining* in a dictionary. Does the fish have a streamlined shape? Look at the shapes in the diagrams. Which shapes are streamlined? Which objects are streamlined so that they can easily pass through air? Through water?

Read about where goldfish came from and why they are such an unusual color. Why would this not be a good adaptation if goldfish had to live in our lakes and rivers?

Look at the photographs on this page. What special adaptations can you find? Try to suggest why the adaptation is useful for each animal.

What special adaptations can you find in these photographs?



This activity can be organized by a small group. Remember that there are jobs to be done before, during, and after the activity.



Activity 4:

How does color adaptation help some animals live in their environment?

You will need one hundred toothpicks for this activity. Paint twenty-five toothpicks white, twenty-five red, twenty-five green, and twenty-five blue.

When the toothpicks are dry take them outside to a grassy area. Scatter them over the lawn so that the different-colored toothpicks are all mixed up.

Take a group of your friends to the grassy area and ask them to collect as many of the toothpicks on the grass as they can in ten minutes.

Before they start hunting for the toothpicks, predict how many of each color they will find in ten minutes.

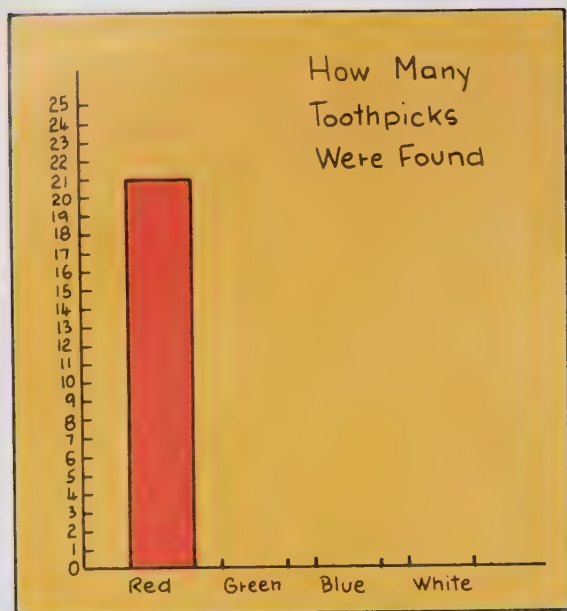
At the end of the ten minutes, ask the pupils to give you all the toothpicks they have found. Now sort them into groups according to their color.



Another member of your group could record the number of toothpicks of each color that each pupil found. You might use a data sheet like the one shown to record what was found.

How many toothpicks of each color do you think will be found?

Number and Color of Toothpicks Each Pupil Found				
Name	Red	Green	Blue	White
1. Wayne	3	1	2	5
2. Marguerite				
3. Otto				
4. Paolo				
5. Lucille				
6. Tim				
7. Olga				
8. Mary				
Total				
Prediction	17			



When you have collected all the data, some members of your group might hunt for the toothpicks that were not found. The rest of the group could use the chart you all made to make a bar graph like the one shown.



Can you find the grouse in this photograph?

Sometimes the animal seems to blend into its surroundings because of its coloring and sometimes because of other things, such as its shape.

Study these photographs. Find the animal in each one and describe how it is camouflaged.

In how many ways is the locust camouflaged? How many locusts can you find in this photograph?

Digging Deeper

Which colored toothpick was the easiest to find? The most difficult?

Did you make accurate predictions? Explain your answer.

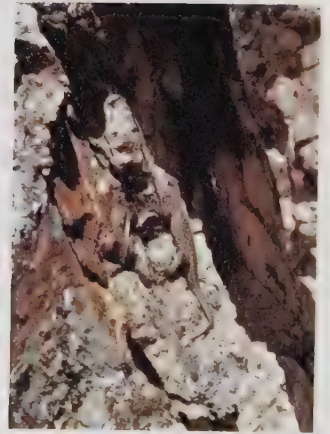
Why do you think that one color was harder to find than the other colors?

Repeat this activity with another group of people and see if the results are the same.

When something blends into the surroundings so that it is difficult to see, it is said to be *camouflaged*. The toothpicks painted green were camouflaged better than the others.

Camouflage is one way many animals adapt to help them live in their environment. Why do you think that some animals would want to be hard to find?





Take another look at your aquarium ecosystem. Remove the cap and look down at your fish. Is it harder to see them looking down from the top than observing them from the side? Try looking at the fish from underneath. How are your fish protected by camouflage?

Branching Out

Plants use camouflage too, but most plants do not try to hide. They try to stand out so that they can be seen. This is called *reverse camouflage*. Study the photograph below to find out why many plants want to be found. Read some books in the library to find out what *pollination* means. How do insects like bees help to pollinate plants?



What is camouflaged in each of these photographs? What kinds of camouflage are shown? What other things can be camouflaged besides animals?



Flower Garden Survey		
Garden	First Color Noticed	Other Colors in Garden
1.	orange	yellow blue
2.		
3.		
4.		



Take a short walk around your school neighborhood. Look at as many different flower gardens as you can find. Write down the color of the first plant that your eyes noticed in each garden. Complete a chart like the one shown.

What kinds of colors did you notice first when you observed the gardens? Compare your results with other members of the class. Did they see the same colors first? Explain why.

Why are all plants not brightly colored?

Why do you think that some plants have brightly-colored flowers? Is it just to look pretty?

Camouflage is a good disappearing trick. The only defence very young deer have against predators is their protective coloring. What part of the deer's coloring provides the camouflage in the photograph on this page?

When the fawn grows older, its white spots begin to fade. Why do you think this happens?

Can you think of any other animals that change color as they grow older?

Some animals change color in winter. Can you think of any? Why do they change color?



Which color did you notice first?

Why do people sometimes use camouflage?

In what ways is the fawn camouflaged?



Differences

6



6. Differences

Have you ever heard the saying “No two people are exactly alike”?

In fact, no two plants or animals of one kind are exactly alike. For example, have you ever seen two rose bushes that are the same in every way? Often the differences are very small, but sometimes they are easily seen. How are four-leaf clovers different?

Knowing the differences within the kinds of living things can often help us to understand important features that make them similar. Also, we can appreciate the great variety that exists in nature. Sometimes this variety allows certain plants or animals to live through harmful changes in the environment.

Activity 1:

How are animals of the same type different?

Look at the pupils in your classroom. In many ways they are all alike, but they are also different from one another. You do not mistake two of your friends for each other very often.

Make a list of ways in which people are similar. Take a survey of ten pupils and make a chart showing their differences.

Animals have similarities and differences too. All dogs may be alike in some ways, but there are many different sorts of dogs. How living things of one type are different from one another is called *variation*. The study of variation is another important part of ecology.



What variations in people are shown in this photograph?



What variations are shown in this photograph?

Record your observations in a chart like this one.

How People Are Different					
Pupil's Name	Sex	Color of eyes	Height	mass	Color of hair
Peter	boy	brown	112 cm	25 kg	brown
Debbie	girl	blue	119 cm	29 kg	blonde

What variations can you see in this photograph?

Find five animals of one type such as dogs, cats, hamsters, pigeons, guppies, or frogs. Record as many differences as you can find in a chart like the one shown. Make more columns if you find other differences to add to the chart.



Digging Deeper

Were any of the animals exactly the same?

Do you believe that you could ever find two dogs that are exactly the same?

Are any of the variations useful to the dog in any way? How is a bloodhound different from a beagle? How is this useful?

Are any of the variations harmful to the dog in any way?

In what ways are all dogs alike?

Do you think identical twins are exactly alike? Explain your answer.

What variation among people has the police found which makes every person unique?

Activity 2:

How can plants of the same type in the same community be different from one another?

You have seen in the previous activity how the pupils in your class can be different. Do you think there are also differences between several plants of one type?

Differences Among Animals of One Type						
	Height	mass	Kind of Fur	Color	Length of Tail	Length of Ears
Dog #1						
Dog #2						
Dog #3						
Dog #4						
Dog #5						

Find an area where a lot of the same type of plants are growing. Some good areas might be in an alleyway, in a vacant lot, on a lawn with weeds in it, or in a pasture.

Choose one type of plant to study. Some different types of plants you might choose are shown in the photographs on the next page.

Find several plants of the type that you have chosen. Now look at the leaves on several of the plants. Are all the leaves the same size?

Which plants would be good to compare leaf size? How many plants should you compare? Perhaps five plants would be a reasonable number.



Primroses. ▲

▼ Chicory.



Goldenrod. ▲

Buttercups. ▼



Daisies. ▲



A common plantain. ▼



The facing page shows some common plants that you can study to show variation.

Being fair in making your choice of plants is more difficult than you might think. How can you be sure that you did not choose only plants that had very large or very small leaves, without really meaning to?

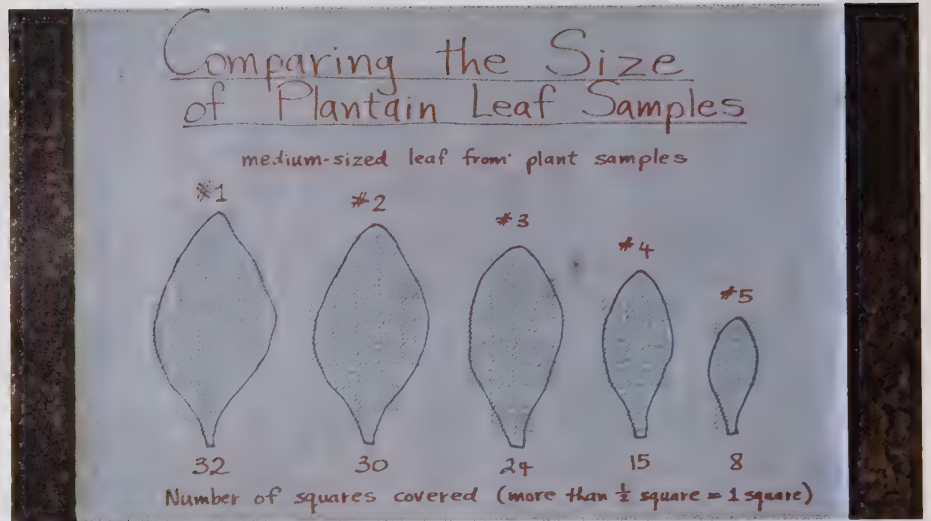
In order to avoid this kind of unfairness, scientists use a method of choosing that is called *sampling*. Here are some sampling methods you might use:

- Toss a ring such as a hula hoop over your shoulder and see if a plant of the kind you want to study is touching the ring or is inside it.
- Set up a number of strings so that they crisscross the area. Choose the plants that are touched by or are under the strings.
- Divide the area into five sections, using string. Choose the plant of the kind you are going to study that is closest to the center of each section.
- Collect twenty-five popsicle sticks. Number each stick from one to twenty-five. Push a stick into the ground beside twenty-five plants of the same type. Place in a hat twenty-five pieces of paper with the numbers 1 to 25 written on them. Draw out five numbers. Use the plants with the same numbers as those you pulled out of the hat.

Try to think of other fair methods that could be used to sample the plants. To be fair you should decide which method you are going to use before you even look at where you are going to take your plant samples.

Which sampling method will you use? What other fair sampling methods can you think of?





Select the method that you think will do the job best. If several groups of pupils are doing this activity, each group could try a different sampling method. Then you could compare results and try to judge in what ways one method was better than another.

If the kinds of plants you selected are weeds, and not somebody's flowers, dig them up carefully so that they remain intact. Put each plant in a plastic bag with a little water and take them back to your classroom to study.

How many leaves from each plant should you look at? Would three be a fair number? By picking the biggest one, the smallest one, and a medium-sized one from each plant, you can obtain a fair sample of leaves from that plant. Use the medium-sized leaf from each plant.

Next decide on a method that you could use to measure the size of each of your five medium-sized leaves.

One method you could use is to trace the outline of the leaf onto paper that has 1 cm squares and then count the squares.

Arrange the five leaves you collected in order from largest to smallest.

Digging Deeper

Which leaf covered the most squares on the paper? Which leaf covered the fewest squares? Which of the five leaves came in the middle?

How much bigger was the biggest of the five leaves than the smallest of the five leaves?

Why was it fairer to decide what sampling methods to use in your classroom instead of at the place where you took the sample?

Measuring the size of different leaf samples using graph paper.

What variation can you see in this photograph of chicory plants?





Branching Out

WHAT OTHER KINDS OF PLANT DIFFERENCES COULD YOU INVESTIGATE?

Look at several samples of the plant that you studied. How many other ways are the plants different? Make a list of all the differences you can find. Your list might include:

- how tall it is
- how long it has been growing
- the amount of ground it covers
- how healthy it looks
- the thickness of its stem
- the outline of its shape
- the texture of the stem or leaves
- the color of the leaves
- the length of the roots

Choose one difference from your list and investigate it more fully. Perhaps small groups of pupils could investigate the other differences on the list.

Decide on a sampling method that will help you to select five plants of one type. Next decide how you will measure the difference you chose from your list. If you chose the thickness of the plants' stems, you could mount the five plants on cardboard in order to compare them.

The amount of ground covered could be measured by boxing in the plant with pieces of cardboard and measuring each side of the box. You would not have to dig the plants up to do this.

What kind of difference is being measured in each of the photographs on this page?



The photographs on this page show ways you can investigate some environmental conditions.

You could use a chart like the one shown to help you record and compare the differences you or your class investigated. Compare the results that all the groups found for one type of plant.

Did the plants with the largest leaves have the thickest stems?

Were the plants which covered the most ground the tallest?

Did the tallest plants have the thickest stems? The largest leaves?

What could have caused the plant differences that you measured? Try to list some possible reasons. Your list might include such things as sunlight, shade, moisture, temperature, food supply, drainage, and other soil conditions. How could you investigate environmental conditions such as these?

Plant Differences We Found					
Sample Plant Number	Type of Difference Measured				
	Leaf Size	Plant Height	Stem Size	Ground Covered	Plant Shape
1.					
2.					
3.					
4.					
5.					



Time Brings Changes

7



7. Time Brings Changes



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What are some of the changes that take place in an environment as time passes? For example, how might the plant and animal populations in a community change when the young trees have grown tall and spread their branches?

What might happen to the *kinds* of plants and animals that live in the community?

It is important to know the kinds of changes and how long they will take to happen. Then we can make plans for the future and make sure that we do not interfere with these changes in a harmful way.

Activity 1:

How do communities change?

There are many changes that take place in your community. How have your grandparents changed from the time when they were children? Have any of your neighbors died or moved away? Have new children been born? Has anyone on your street moved? Have any new buildings or homes been built? What other changes in your community can you think of?

Plant and animal communities also change. Sometimes these changes happen very suddenly, but they are usually very slow and take a long time. These changes are called *succession*. Succession in plant and animal communities is a part of ecology.

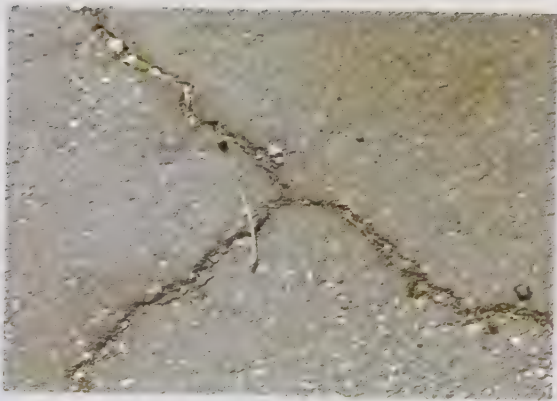
By comparing different paved areas such as driveways and parking lots, you can see some of the changes that take place in one type of succession.

How long does it take for a tree to become fully grown?

How many changes like the one shown in the photograph have you noticed in your community?



New asphalt paving only a few months old.



Asphalt paving about 3 to 5 years old.



Asphalt paving about 10 to 15 years old.

Look at the photographs of asphalt paving. Now go out into your community and try to find paved areas that match the photographs.

For each paved area you visit try to estimate the age of the asphalt by comparing its color with that of the asphalt in the photographs.

Bend a coathanger into a square. Place the square over an area of asphalt. Now count the number of cracks inside the coathanger. Measure the width of some of the largest cracks with a ruler.

Press a piece of Plasticine onto the surface of the asphalt. This will make a print of the surface and show how rough or smooth it is.

Now place your coathanger square along the edge of a section of asphalt. Count the number of plants growing inside the square and measure the height of the tallest plant.

Record your findings in a chart like the one shown.

Different Asphalt Surfaces							
Asphalt Sample Number	Color	Number of Cracks	Width of Cracks	Number of Plants	Height of Plants	Roughness of Surface	Age
1.							
2.							
3.							
4.							
5.							



Using a coathanger square to count the number of plants. ▲

Measuring the width of the cracks. ▼



Making Plasticine prints to show the roughness of the surface. ▼



Digging Deeper

Where was the oldest area of asphalt that you found? The newest?

Which paved area had the lightest color? The darkest color?

Which paved area had the most cracks? The widest cracks?

How is very old asphalt different from very new asphalt?

What do you think might have caused the differences in the roughness of the surface of the asphalt? Why is roughness not a reliable clue to the age of asphalt?

What will the plants, roots, and chemicals from the plants do to the asphalt?

How would freezing water make cracks in asphalt? Place a full jar of water with a tight lid on it in a paper or plastic bag in the freezer section of your refrigerator. Examine the jar the next day.

What would eventually happen to asphalt if it were left alone for a long time?

Look at this photograph of a section of an asphalt highway that is no longer used. What has happened to it?

Comparing the color of the asphalt.

This road was replaced with a new highway. What evidence of succession can you see?



Have you found places that look like these? What do you think will be the final stage of succession in each photograph? Why?



Branching Out

Changes that occur in succession usually take a very long time. It may take hundreds or thousands of years before the final stages are reached. Sometimes it is easy to see what is happening, other times it may be hard to see anything at all. What changes can you see in the photographs on this page? Try to describe how these areas might have looked long ago, and how they might look a long time from now.



*Will the mass of the grass cuttings change as they dry?
What causes this change?*

Activity 2:

How does dead plant and animal life in your community change from day to day?

What would happen in your community if the garbage in the dumps continued to pile up? What would happen on the highways if all the animals killed by cars remained by the side of the road? What would happen in a forest if all the trees that died stayed there? What would happen to your lawn if all the cut grass and fallen leaves remained on the ground?

To find out how some dead plant and animal life changes, try some of the following activities.

Activity 2(a):

What happens to lawn cuttings?

Examine a lawn that was cut about two weeks ago. Try to find some of the cuttings. Compare the grass cuttings with the growing grass. How is their color different? Have the cuttings changed in size? Do they feel like growing grass? Are they as strong?

When the lawn is being cut at your school or home, collect a bag of fresh grass cuttings. Find the mass of the bag of cuttings by using a balance. Spread the cuttings out on a newspaper to dry in a sunny place. Find the mass of the bag alone. After several days, put the cuttings back in the same bag and find their masses again. Complete a chart like the one shown.



How the Mass of the Grass Cuttings Changed	
Items measured	Mass in grams
1. Bag and fresh cuttings	
2. Bag alone	
3. Fresh cuttings alone (Subtract #2 from #1)	
4. Bag and dried cuttings	
5. Bag alone (same as #2)	
6. Mass Lost by cuttings (Subtract #5 from #4)	

How will the mass of these dead worms change after several days?

Digging Deeper

How much lighter were the cuttings when dried than when freshly cut?

What did the heat from the sun remove from the cuttings? How much water does grass contain?

What soon happens to the dried remains of grass cuttings left on the lawn?

This process is called *decay*. Why do we not really notice decay on the lawn? How does decaying grass help the lawn?

Branching Out

If you cut your lawn twelve times a year (every two weeks for the growing period of six months) and each time you cut off 2 cm, how much grass would be cut off in one year? What becomes of all this grass?

After a heavy rainfall look on driveways or sidewalks for some dead earthworms. Put the worms on a paper towel to remove any extra water. Place a clean paper towel on a balance, then put the earthworms on the paper and find the mass of the worms and the paper. Pins or tacks can be used as the unit of mass.

Next, place the towel and the worms on a sunlit window ledge indoors and leave it for several days. When the worms are completely dried out, find the mass of the towel and the worms again.



Be sure to wash your hands thoroughly after handling the worms.

What was the mass of the worms at the start? What was the mass after several days? How much mass did the worms lose?

What was removed when the worms were placed in the sunlight? Is an earthworm's body mostly water or is it mostly other things?

What do you think eventually happens to the bodies of dead worms?

Place the apple in a place that will not be disturbed.

Activity 2(b):

What happens to fallen apples?

Find a shady spot near some trees or bushes. Find a spot that will not be disturbed by other people.

Sharpen a small stick at both ends. Push one end of the stick into the ground. Push an apple onto the other end of the stick so that the apple is well secured.

Visit the apple each day for several days. Record the dates of your visits and any changes you see taking place in the apple.





What changes took place? Did you see changes like the ones shown below?



Digging Deeper

Why did you put the apple on a stick?
 How long was it before you noticed any smell?
 When was the skin first broken?
 What animal life did you see visiting the apple?
 How could you find out if anything visited the apple at night?
 If no animals visit your apple, what other things might be causing it to change?
 What would eventually happen to the apple if you left it there long enough?

Branching Out

Find a small area in a garden or a vacant lot. Cut a slice of luncheon meat into 2 or 3 cm squares. Place the pieces on the ground in various places. Mark each place with a stick or stone.

Make a sketch map of the area where you placed the luncheon meat squares. Record on the map any changes that you see in the meat.

Stand a short distance away from the meat to observe it. Watch it for at least fifteen minutes on the first day. Leave the meat overnight and then look at it the next day. Do the same thing for one more night and day.

What type of visitors came to the meat first?

Which pieces of meat were moved? What moved them?

How many fewer pieces of meat were left each day?

What would eventually happen to all the squares of meat if you left them there long enough?



Cutting the meat into squares.



Mark the location of each square.

What might cause the squares to disappear?





What caused the changes you can see in these foods? Under what conditions?



Activity 2(c):

What effect do air and water have on what happens to food?

Find two pieces of stale bread and two pieces of dried orange peel. Make sure they are about the same size and the same age.

Place one piece of each food sample in a plastic bag and then seal the bag with string or an elastic band. Place the second piece of each food sample on a moist piece of paper towel.

Store all the samples in a drawer or cupboard for about one week. Bring them out and compare the pieces that were exposed to the air with the pieces that were not.



Digging Deeper

These are molds.

Which pieces of food had mold growing on them? Which did not?

Where do you think the mold came from? What are some conditions that help molds to grow?

Where do you think the mold gets its food from? What kind of interrelationship is this?

Changes in dead plants and animals are called decay. How does decay change the size of the plant or animal? Its smell? Its color?

When a plant or animal decays, what it is made of changes to something else. The things that bring about these changes are called *decomposers*. Many decomposers are so small they can only be seen with a microscope. List some decomposers you saw in the activities you tried.

When a plant or animal decomposes, its body is changed into something that can be used by other plants and animals. This is called *recycling*. Recycling is an important part of ecology.

Did you find logs like the ones shown in these photographs? How do you know decay is taking place? Under what conditions do you think the first log might eventually look like the one below?

Branching Out

Take a walk around your school neighborhood and make a list of all the things that have been thrown away that you can find. Record each item in a chart under the following headings:

- Will Decay Quickly
- Will Decay Slowly
- Will Not Decay

Which of the items on your list could be used again by people? Using discarded things again is another kind of recycling.

What is pollution? How would thousands of glass bottles and plastic materials thrown into dumps defeat nature's decomposing system?

Go for a walk in a wood and find some old tree stumps or branches that have been lying on the ground for a long time. You could also look at a dead tree that hasn't fallen yet.

Use a table knife or a spoon to pry off pieces of bark and woody material. Record your observations on a chart like the one shown.

Which tree had been dead the longest? Which tree had decayed the most?

Which part of a tree decomposes first? Last?

How do insects and other animals help the log to decompose? In which stage of decay did you find the most animals or insects?

What forms of plant life also help to decompose dead or dying trees?



Dead Trees We Observed				
Description of Tree	Condition of Bark and Wood	Plant Life Observed	Animal Life Observed	Other Observations
1. old, fallen log	bark nearly all decayed wood crumbly	moss fungus molds	centipede ants grubs spiders	animal burrow under log ant eggs in wood
2.				
3.				



Activity 3:

How does a piece of bare ground change over several weeks?

Find an area of ground in the schoolyard or your backyard that you can dig up. You must be able to leave it alone for several months. It should be about 1 m².

Use a spade or shovel to turn over the soil. Do a thorough job of removing all plant life such as roots and stems.

Observe your cleared plot of ground one day each week for at least two months.

Prepare a map of the plot of ground. Every week record on the map all the information about the changes in the plot that you have noticed. Include such things as where new plants have grown and any changes in the size of the plants. You could use different colors each week when adding new observations to your map.

To help you record the growth of plants more accurately on your map try this method. Tie two pieces of string across a hula hoop to divide it into quarters as shown in the photograph. Place the hula hoop over your plot of ground in the same position each time you make observations.



The strings will help you to see exactly where changes have taken place. Draw lines similar to the strings on your map to help you chart the changes you observe.

Be sure to add a legend to your map showing the dates observations were recorded and what objects each color stands for. How could such information as the heights of plants be shown?

What kinds of changes can be shown on the map of this plot of ground from week to week?

Digging Deeper

In what part of your plot did plant life first appear?

After how many weeks did the first plants start to grow? From where did these plants come? How do you think they got there?

Did the plants grow in groups or were they evenly spaced?

How many kinds of plants finally grew in the plot? How many were there of each kind?

How did the height of the plants change from week to week? Were there more tall plants or short plants after two months?

What animals or birds visited your plot? Look for tracks or droppings.

When did insects first visit the plot? What kinds of insects visited the plot? How did the numbers and types of insects change from week to week?

How did the color of the soil change? Did the soil particles get lumpier or smoother? Did they become more loose or more packed together? Did the soil particles become wetter or drier?

What do you think the plot of ground would look like one year from now? Ten years from now? What would eventually happen to your plot if succession went on undisturbed for a hundred years?

Branching Out

In the spring, ask your parents or the school caretaker to leave a patch of grass uncut till the fall. Mark out the edges of the plot with sticks and string. Examine this plot of grass every week. Make a map of the plot and mark on it all the changes you see each week. You can use a hula hoop to help you see the changes as you did with the bare ground.

What changes happened during the spring, summer and fall? How were they different from the changes that took place on the bare ground? Are changes that take place from season to season really succession?



Would rough ground with hills and hollows develop new growth in the same way as flat ground? What would happen on sloping ground?

How is the balance of nature being preserved in this photograph? How do people benefit from this?

Now that you have done some of the activities in this book, you know that people often upset the balance of nature by harmful actions. Pollution of the soil, air and water and thoughtless cutting down of trees are some examples. Can you think of others?

People can do helpful things too. How important are tree planting projects and proper waste disposal to the balance of nature? What other helpful things can people do?

You are part of the balance of nature. Have you done harmful or helpful things? How will you act in future?

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Chapter 6 Differences

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Chapter 7 Time Brings Changes

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How do communities change?

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How does dead plant and animal life in your community change from day to day?

Glossary

Adaptation: A change or changes in the structure or habits of living things which allows them to live in a changed environment.

Balance of nature: The result of all the relationships among living and nonliving things.

Camouflage: The way in which a living thing appears to blend into its surroundings and becomes hard to see.

Carrying capacity: The amount of life that a piece of land is able to support or provide food for.

Commensalism: A relationship between two living things which benefits only one member, but does not harm the other.

Community: Groups of plants and animals which live in the same area.

Conservation: Preserving and using our natural resources wisely.

Consumer: Any living thing which uses something produced by another.

Decay: To break down or change from complex into simpler substances, for example, to rot or decompose.

Decomposer: A plant or animal which causes dead matter to decompose or decay.

Ecologist: A person who studies ecology.

Ecology: The study of the relationships that exist among plants, animals, and the environment.

Ecosystem: A community of living things interacting with each other and their environment.

Energy crisis: When natural energy resources cannot meet people's needs.

Environment: All the living and nonliving factors which make up the surroundings of any living thing.

Factor: Something that has an effect on life. In an experiment, something that might affect the results.

Fair: In an experiment, keeping the factors the same in order to compare the results.

Food chain: One set of producer and consumer relationships within a group of living things, from the original producer to the final consumer.

Food web: A number of connected food chains in a community.

Galls: Lumps or swellings produced on the leaves, stems or other parts of a plant. Galls are caused by insects.

Habitat: The place where a particular plant or animal naturally lives.

Interrelated: Closely connected with one another; having an effect on one another.

Interrelationship: How plants, animals, and the environment affect one another.

Larva: The wormlike stage between egg and pupa of insects. Two or more of them are called larvae (pronounced *lar-vee* or *lar-vi*) or larvae. Maggots, grubs and caterpillars are examples of larvae.

Migrate: To travel from one place to another with the change in season.

Natural resources: Those parts of the environment which allow life to continue and the balance of nature to be kept.

Overpopulation: Too many living things of the same type in the same community. When there are too many, some may die because there is not enough food for all of them.

Parasite: A plant or animal which gets its food by living on or inside another living thing, but does not give anything in return. This interrelationship is called parasitism.

Pollination: In plants, the transfer of pollen from the stamens to the pistils, allowing the plant to produce seeds.

Pollution: Damage to the environment caused by harmful substances which upset the balance of nature.

Population: The number of individuals in a group.

Predator: Any animal which preys on or hunts and eats other animals for food.

Producer: Any living thing which makes something which is used or consumed by another living thing.

Product: What a producer makes.

Pupa: The stage between larva and adult of insects. Two or more are called pupae (pronounced *pew-pee* or *pew-pi*) or pupas.

Recycling: Reusing something after it has already been used.

Relationship: The effect that one thing has on another.

Reliable: Can be depended upon or believed.

Sampling: Selecting or choosing certain members of a group in order to show what the whole group is like.

Streamlined: Having a shape which allows rapid movement in either air or water.

Succession: The changes that take place in a community over a long time.

Symbiosis: A relationship between two living things which benefits them both.

Territory: An area which an animal senses to be essential for life, which the animal defends against other animals, particularly of its own kind.

Variable: Something that can be changed.

Variation: Differences among living things of the same type.

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